Union Pacific Railroad Crossing Study

West - East Main Line Corridor

December 2002

Office of Systems Planning

Iowa Department of Transportation

Table of Contents

List of Figures

List of Maps

List of Photos

List of Tables

Introduction

Nationwide, the challenge of ensuring public safety at rail-highway grade crossings continues to be a top priority. The statistics are staggering—3,502 collisions between trains and motor vehicles resulting in 425 people killed in 2000 alone. An additional 1,219 personal injuries were reported from these rail-highway crossing collisions. During the same year, there were 109 rail-highway collisions in Iowa resulting in 16 people losing their lives. An additional 35 personal injuries occurred at Iowa's rail crossings.

This level of collisions, fatalities and personal injuries at rail-highway crossings is a critical transportation issue because of the high financial and emotional cost to Iowans. The Iowa Department of Transportation (department) and railroad companies operating in the state, as well as cities and counties, are constantly working together through an array of avenues to provide greater safety to the traveling public.

The first step in assessing rail-highway crossing collisions is to establish a common understanding of the widespread rail-highway network, its operations, and public safety implications. Basically, two issues must be addressed. First, limited financial resources necessitate that statewide rail-highway crossing improvement needs be evaluated and an overall investment strategy be developed. Second, Iowa's rail system is quite extensive; consisting of 4,182 miles of track and 5,595 public roadway crossings identified by the Federal Railroad Administration (FRA). This large number of crossings reflects the state's extensive rail and highway network and grid system of past highway construction in the state.

Iowa Administrative Code Chapter 812 addresses classifications and standards for rail-highway grade crossings. This statute requires the department to classify grade crossings based upon their characteristics, conditions and hazards, and to adopt standards for warning devices for each classification. It does not, however, address warrants for grade separation structures.

There are two statistical measures used in Iowa to determine whether a rail crossing needs improvement--predicted accidents and exposure. These are both described in the Iowa DOT Policies and Procedures manual under Policy No. 500.09. These two measures do not, however, address warrants for grade separation structures.

Study and Purpose

The purpose for this study is to develop a thorough assessment of rail-highway crossings in Iowa. With 5,595 FRA crossings statewide, the task of studying all crossings is overwhelming. Therefore, this study will focus only on the rail line with the highest train traffic, which is the Union Pacific Railroad's west-east main line across Iowa (hereinafter referred to as the UP Corridor). This line runs from the Missouri River to the Mississippi River and carries more trains per day than any other rail line in Iowa. The results of the study will help develop investment strategies for crossings on the UP Corridor, including separations and closures. The objective of the study is to assist in the development of a long-range plan to provide direction and guidance for the investment in and implementation of rail-highway crossing improvements on Iowa's main line rail system.

City, State and Federal Crossing Activities

Background

A literature search was made of existing studies and activities to provide a background basis for this study. The search results provided valuable information on the following activities at the city, state and federal levels.

City Crossing Studies on the UP Corridor

Several cities in Iowa have been involved in studies to review existing conditions of rail-highway crossings within a study area. These include studies as part of the Iowa Traffic Engineering Assistance Program (TEAP) in cooperation with the department and the U.S. Department of Transportation--Federal Highway Administration. The purpose of these feasibility studies is to review specific conditions and include studies that evaluate the impact of specific crossing improvement alternatives.

The following is a brief overview of the opinions, findings, and conclusions for current studies that involve crossings along the UP Corridor:

City of Boone, Union Pacific Railroad Crossing Study

TEAP study, Consultant--Snyder & Associates Inc., December 1998:

A) modify the traffic control to conform with the Manual on Uniform Traffic Control Devices;

B) locate a grade-separated crossing at Greene Street; and

C) close the at-grade crossings at Coal Road, Division Street, Crawford Street, Carroll Street, Greene Street, Story Street, and R Avenue.

City of Ogden, Union Pacific Railroad Crossing Study

TEAP study, Consultant--Snyder & Associates Inc., September 14, 1999:

A) modify the traffic control to conform with the Manual on Uniform Traffic Control Devices;

B) locate a grade-separated crossing at North 1st Street (P-70); and

C) close the at-grade crossings at NW 4th Street, N 1st Street, and NE 3rd Street.

City of Ames, Dayton Avenue Reconstruction Project

Lincoln Way to East 13th Street, Consultant--Snyder & Associates Inc., September 2000

The only way to adequately plan for the high volume of traffic for the future is a grade separation of Dayton Avenue over the Union Pacific Railroad (UP). It is recommended the railroad bridge be constructed initially at a sufficient width to facilitate the ultimate five-lane roadway. The UP has also mandated the crossing be constructed for the addition of a future third set of tracks. According to traffic data from the City of Ames and the UP, it has been shown that a grade separation would benefit motorists on Dayton Avenue by decreasing delays and improving safety.

City of Ames, Duff Avenue/Union Pacific Railroad Crossing Study

Universe of Alternatives Interim Report, Consultant--HWS Consulting Group Inc., February 7, 2002

This report contains a number of alternative plans that range from improving the existing at-grade crossing to providing separated underpass or overpass options. It also contains broader options, such as building a “bypass” rail line around the community. All of these long-range alternatives mitigate to some degree traffic safety and efficiency problems at this crossing. After a complete discussion with the community and business leaders, the consultant will proceed to “short list” these alternatives to four design alternatives (including a “do nothing” alternative) for further review. After this evaluation, the consultant will then provide a recommendation for the final alternative.

Factoid: According to the FHWA Safety Report, the Section 203/130 Program is responsible for saving more than 8,000 lives. This safety improvement program has the highest accident rate reduction of all highway safety programs supported by federal funds.

City of Boone, Grade Separation Feasibility Study

Consultant--WHKS & Co. Consulting Engineers and Planners, March 2002

The alternatives considered were narrowed to four preferred alternatives. They are:

1) improve the existing underpass at Benton/Linn;
2) add a new underpass at Division Street;
3) add an overpass at the extension of Roger Snedden Drive; and
4) provide interim drainage improvements at the existing underpass.

The recommended implementation plan states the first priority is to implement interim drainage improvements at the existing underpass. The second priority is to pursue annexation of the industrial area to the east and to construct the Roger Snedden Drive extension alternative. The third priority is to pursue special legislative funding, general obligations bonds, or local option sales tax for the construction of the Benton/Linn underpass improvements. Further traffic analysis is needed to determine the benefit-cost ratio between the two-lane alternative and the four-lane alternative.

Factoid: There are approximately 532,400 highway vehicles crossing the UP Corridor each day in Iowa.

State Activities

Other states also have been involved in a variety of grade separation analyses. Some of these activities are as follows:

Illinois

The Illinois DOT provides guidance for grade-separated structures in the Railroad Section of the Bureau of Design and Environment Manual. It states that a grade separation should be provided where a highway is constructed or reconstructed across a railroad when the accident frequency at a gated crossing exceeds 0.02 and the benefit-cost ratio equals or exceeds 1.0. It also states a grade separation should be provided where an expressway in a rural area is constructed or reconstructed across the railroad. The Expected Accident Frequency (EAF) is a product of a traffic factor (based on a factor derived from vehicles per day), a component factor (derived from a value based on existing protection devices), and the current number of trains per day. An exposure index rather than the EAF is the basis for separation considerations. The benefit-cost ratio is determined by the cost of an accident (ratio of deaths and injuries per accident times the cost per accident) divided by the cost of a proposed installation.

They have been involved in a pilot study of advisory rail onboard vehicle warning systems at railroad grade crossings. This technology could significantly reduce fatalities at crossings. They are also testing positive train control (PTC), a communications system technology in which the crossing “talks back” to the train.

Indiana

In June 1999 the Indiana governor announced an initiative to speed up the process of railroad safety project implementation in Indiana. The state is ranked third in the nation in the number of rail grade crossing collisions, fourth in the number of railroad crossing fatalities, and fifth in the number of railroad crossings. Under this new legislation the state will pay 100 percent of the costs to update several safety projects, which were rated as priority projects by the Indiana DOT. Approximately $8.5 million in funding will come from a portion of Indiana’s federal Surface Transportation Program (STP) funds that are to be set aside for rail-highway safety projects. Eligible projects under this initiative include adding stop signs and gates at crossings, adding flashing signals or gates, consolidating crossings, and constructing overpasses and underpasses. The formula for determining the predicted accident rate uses data collected about the top 20 percent of the crossings with the highest reported incident rates. Priority projects are ranked according to a benefit-cost ratio.

Michigan

The Michigan DOT has a new Grade Separation Loan Program. The new program is funded with $4 million in state funds. Eligible applicants are local road authorities. They may borrow up to 100 percent of the cost to construct the overpass or underpass, to be paid back over a period of up to 15 years. The goal of the program is to construct grade separations where essential local roads must intersect railroads. In June 2001 all 372 local road authorities were contacted regarding this program. The first applications were received in December 2001 and were prioritized on the basis of safety and mobility benefits. Loans authorized under the program are charged minimal interest; however, if a payment is missed, the remaining balance will be charged prime interest rates. Loans are available for preliminary engineering and design, and for 100 percent of the construction of new structures.

Minnesota

Minnesota State Code outlines criteria for when rail-highway crossings may become eligible candidates for grade separations. If a crossing meets one of the following conditions, it is a candidate for a grade separation:

- Four-lane roadways with train speeds greater than 40 mph and roadway speeds greater than 30 mph and average daily roadway traffic greater than 5,000 vehicles.
- Four-lane roadways with train speeds greater than 40 mph and roadway speeds greater than 55 mph and average daily roadway traffic greater than 3,000 vehicles.
- The crossing has active warning devices, and there has been a vehicle-train collision involving a fatality or two property damage/personal injury collisions within the last five years.
- An increase in public safety would result from construction of the grade separation by eliminating another safety problem area such as a crash-prone roadway intersection.

Minnesota uses these criteria in evaluating crossings. If these criteria are met, the crossing is red flagged as requiring further in-depth study for its grade separation need.

The Minnesota DOT uses an exposure index factor (average daily traffic times number of trains) of greater than 5,000 to determine if signals should be considered. If signals are recommended, gates should be added if there are multiple main line rail tracks or train speed is 40 mph or more.

Missouri

The Missouri DOT does not have strict warrants for grade separations, but looks at potential projects on a case-by-case basis. At one time, they had a task force that reviewed warrants but it was of little value. As with all states, they now utilize a joint diagnostic team to perform yearly reviews for eligible rail-highway crossing safety projects consisting of local, state and railroad representatives. Statewide priorities are developed using an Exposure Index that looks at volume of vehicles, volume of trains, vehicle speed, train speed, and sight distance. A major component of the index is the Traffic Index that evaluates the number of daily trains, maximum allowable train speed, average daily vehicle traffic count, and normal vehicular operating speed.

Nebraska

In 1997 the Nebraska Legislature directed the Nebraska Department of Roads (NDOR) to develop a process for assessing risk at highway-railroad grade crossings. This placed the responsibility for ensuring public safety at these crossings with the NDOR. Nebraska leads the nation in the average number of highway-rail grade crossings per mile, and they lead the nation in density of train traffic. They have nearly 7,000 crossings, about half of which are private crossings. In response to this directive, the NDOR contracted with a team of engineering, design, public involvement and economic analysis professionals. These consisted of HNTB Corporation of Kansas City, Missouri; Richards & Associates of College Station, Texas; Hammer Siler George Associates of Denver, Colorado; and AT&T Ventures of Burke, Virginia. The project is a nominating process only. The purpose was to approximate the magnitude of improvements needed statewide to reduce the risk at public and private highway-railroad grade crossings. The legislative mandate for the study specifically called for a broad-based public involvement program. Phase I, the public involvement and development of assessment process, was completed in November 1998. Phase II, implementation of the assessment process, and Phase III, development of improvement funding options, were completed in June 1999.

North Carolina

North Carolina DOT staff, in 1995, began studying how best to separate railroad and highway traffic. They determine the need for improvements and/or elimination of public grade crossings through the use of comprehensive evaluations of overall traffic patterns and road use for an entire municipality or region. They have completed traffic separation studies for 17 communities, with 19 crossings that have been closed and several others improved as a result. Work is underway in several cities to implement recommendations, and additional studies are underway in several other cities.

Their grade separation guidelines are based on use of an exposure index, which is the product of the number of trains per day and the projected average daily highway traffic. Separations should be constructed in rural areas when the exposure index is 15,000 or more. Separations should be constructed in urban areas when the exposure index is 30,000 or more. Where two alignments are under construction and one would make separation feasible, the separation should be considered as one factor favoring adoption of such alignment. It is realized that topography, right-of-way costs, construction costs or other features of the physical situation may make separation impractical even though the index is above the figure set. In this case, the DOT secretary has final authority in decisions to create new at-grade crossings. DOT policy permits no net increase in the number of at-grade crossings on the rail segments having a high volume of train traffic.

Ohio

Ohio is one of the first states in the nation to establish a program to specifically address rail-highway grade separation projects. They recently conducted a study and found approximately 40 Ohio grade crossing sites have at least 30 trains and 1,000 vehicles a day. In response, they developed a 10-year, $200 million Rail Grade Separation Program led by the Ohio DOT and the Ohio Rail Development Commission (ORDC). They received over 74 applications totaling over $450 million. Projects were divided into three tiers: those that have a completed feasibility study, those identified for further development, and those that failed to satisfy program goals.

The tests for project eligibility are as follows:

- Does the crossing negatively affect the quality of life, safety or economy of an Ohio community?
- Is the project requested by the community?

- Does the crossing have more than 30 trains per day and an average daily traffic (ADT) of 1,000 vehicles?
- Does the crossing isolate emergency services (e.g. police, fire, EMS, hospitals, etc.) or school facilities?
- Does the site have a nearby grade separation?

The vast majority of project crossings will not be studied further because they fail to meet the qualitative measures or are below the quantitative threshold of 30 trains per day and an ADT of 1,000 vehicles per day. However, if the sponsor of a failed project can demonstrate a severe negative impact on the quality of life in a community, the project may be included for funding. Funding will come from the Ohio DOT, the ORDC, federal earmarks, railroads, local governments, and other state revenues/general revenue funds.

Wisconsin

The Wisconsin DOT follows its “Facilities Development Manual” concerning grade separations, which states that grade separation project selection is based on a favorable analysis of the following:

- in rural areas, separation of grade structures should be considered when the highway design speed exceeds 50 mph and the exposure index factor (average daily highway traffic times number of trains) exceeds 75,000;
- in urban areas, separation of grade structures should be considered when the exposure index factor exceeds 100,000;
- the existing terrain is economically suitable for separating the railroad/highway grades;
- the construction of a crossing at-grade is deemed uneconomical, excessively hazardous and would not serve the public interests; and
- the construction/maintenance cost analysis indicates a separation structure is cost competitive with an at-grade crossing.

The Wisconsin DOT's Facilities Development Manual recommends consideration of automatic flashing lights when the exposure index factor at a crossing exceeds 5,000-7,000 in an urban area. Consideration of installing automatic gates is called for when the exposure index factor exceeds 20,000.

Federal Activities

A draft report entitled “Guidance on the Selection of Traffic Control Devices at Highway-Rail Grade Crossings” was published in July 2002 and will be released to the public in the fall of 2002. (The report will also be located on the FRA’s Web site.) It is based on the findings of a Technical Working Group representing a variety of transportation-related interests. The report contains guidance on when to build grade separations. These guidelines seem to be quite high for Iowa.

For example, some of the thresholds include:

- highway average daily traffic level greater than 100,000 urban or 50,000 rural;
- train traffic greater than 150 trains per day;
- exposure greater than 1,000,000 urban or 250,000 rural; and
- posted highway speed of 70 mph or above.

Other Activities

There were three documents prepared in a study on grade separations by The TransTech Group, Inc. of Palm Harbor, Florida. The purpose of the study was to set forth a logical procedure for the engineering analyses of highway-railroad grade separation proposals. The first was Work Paper 1--A Literature Survey that summarized a literature survey concerning grade separations. The second was Work Paper 2--A Survey of State DOT Procedures Regarding Highway-Railroad Grade Separations that summarized the responses from the states. These two work papers were completed in November 1998. The third was the final report entitled "A Procedure for the Provision of Highway-Railroad Grade Separations" completed in April 2001 that presented a recommended procedure and summarized the entire study.

Factoid: Rail freight traffic in the United States is expected to double over the next 25 years.

Factoid: If there is a malfunction of an active traffic control device (gates or flashing lights), the default mode for the device is activated (the signal or gates turn on).

Photo 1 – Grade Separation in Ames

Railroads in Iowa

Service

Iowa is served by 19 railroad companies, which operate 4,182 miles of track (see Map 1). The Union Pacific Railroad (UP) is the largest provider, operating 1,603 miles, or 38 percent of the total. Table 1 lists rail companies in Iowa that serve shippers in Iowa, except for the TKEZ which is a private operation.

Table 1 – Rail Companies in Iowa

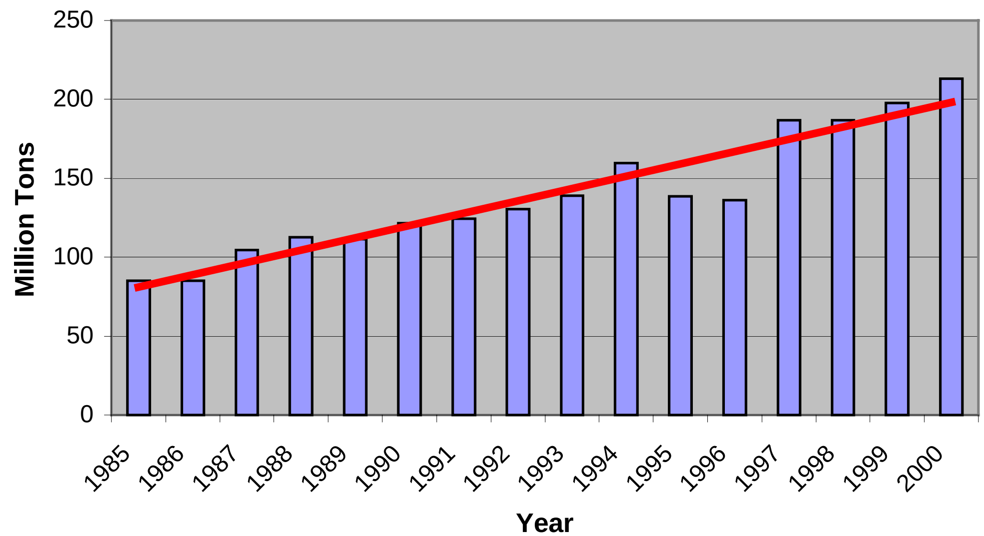
RR Code	Railroad
APNC	Appanoose County Community Railroad Inc.
BSV	Boone and Scenic Valley Railroad
BJRY	Burlington Junction Railway
BNSF	Burlington Northern Santa Fe Railway Co.
CBEC	CBEC Railway Inc.
CC	Chicago, Central and Pacific Railroad
CIC	Cedar Rapids and Iowa City Railway Co.
CEDR	Cedar River Railroad Co.
CBGR	Council Bluffs Railway Co.
DAIR	D & I Railroad Co.
DME	Dakota, Minnesota & Eastern Railroad Corp.
IMRL	I & M Rail Link*
IAIS	Iowa Interstate Railroad Ltd.
IANR	Iowa Northern Railway Co.
IANW	Iowa Northwestern Railroad Co.
IATR	Iowa Traction Railroad Co.
KJRY	Keokuk Junction Railway Co.
NS	Norfolk Southern Railway Co.
TKEZ	T K Evans (Private Operation)
UP	Union Pacific Railroad Co.

*purchased by the Iowa, Chicago and Eastern Railroad (ICE) in July 2002

Traffic

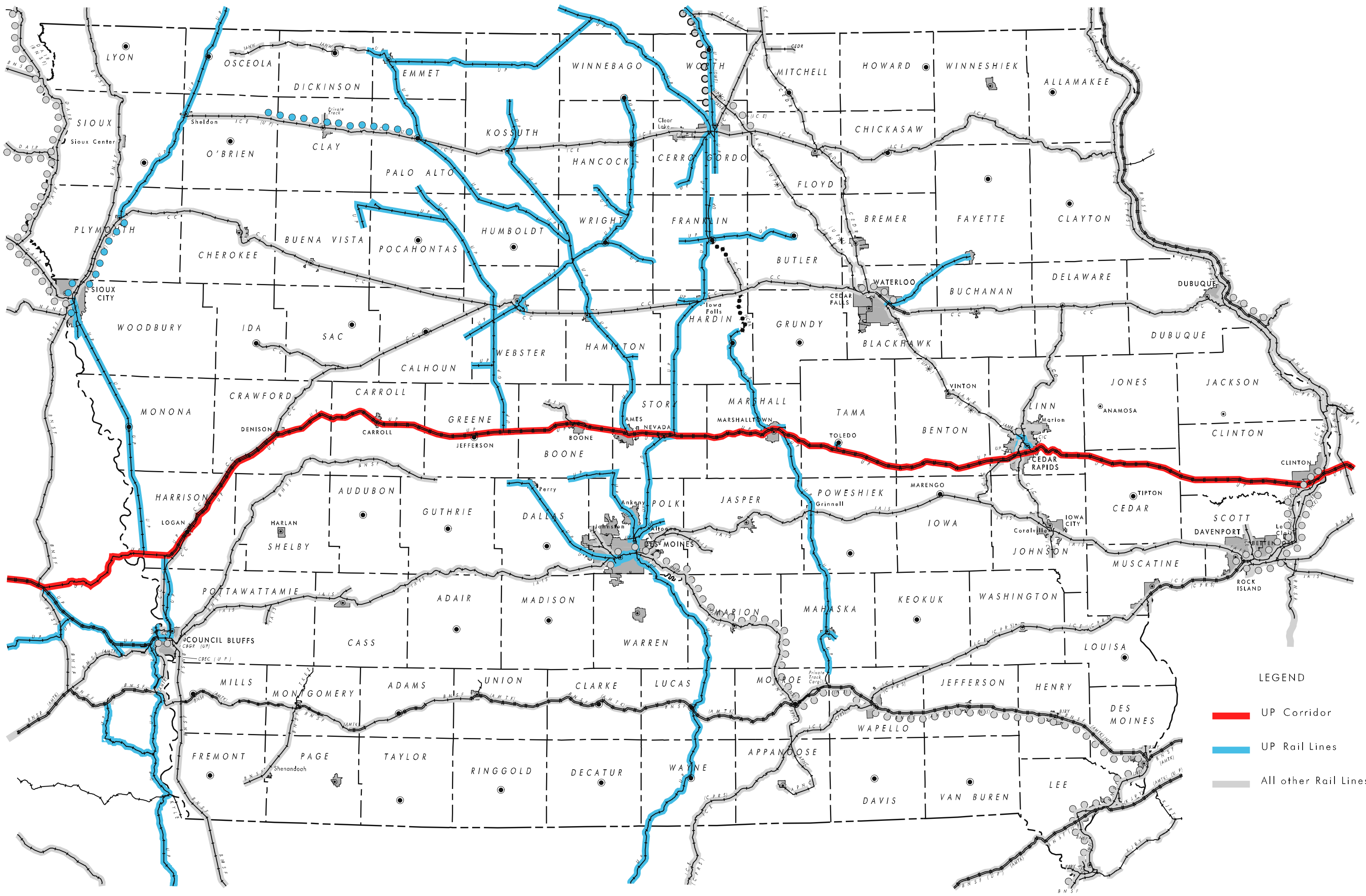
Iowa railroads are carrying more freight over the Iowa rail network than ever before. In total, they carried almost 300 million tons of freight in 2000. Of that total, 213 million tons merely passed through the state. Through traffic during the last 15 years has increased 150 percent from 85 million tons in 1985 to 213 million in 2000 (see Figure 1) and is expected to continue to increase.

Figure 1 – Rail Traffic Moving Through Iowa



The majority of this traffic, consisting of coal and intermodal shipments, traverses the state on the UP's west-east main line located in central Iowa and the Burlington Northern Santa Fe Railway's west-east main line located in southern Iowa. This growing railroad business means an increasing number of trains and longer trains moving within and across the state of Iowa. This will increase the likelihood of train-vehicle collisions at grade crossings.

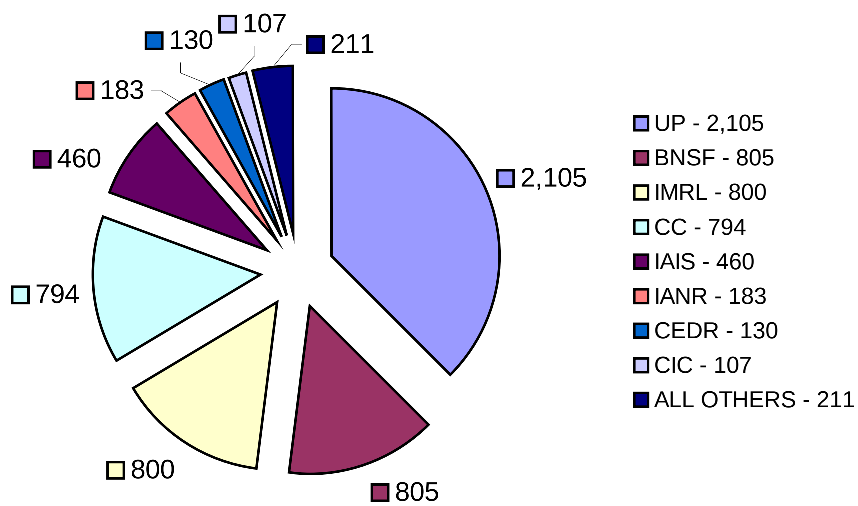
Map 1 – Rail Lines in Iowa



Number of Crossings

Currently, there are 5,595 public rail-highway crossings located on 4,182 miles of rail lines in Iowa, about 1.3 crossings per mile. Eight of Iowa's railroads have more than 100 crossings on their system in Iowa (see Figure 2). The UP by far has more crossings than any other railroad at 2,105 (38 percent of the total).

Figure 2 – Railroads With More Than 100 Crossings in Iowa



The remaining 10 railroads have less than 100 crossings on their rail system (See Figure 3). The DME only has trackage rights in Iowa and therefore has no crossings. The IANW's crossings are included with the UP's crossings.

Type of Crossings

In Iowa, about 14 percent of the crossings are separated from the roadway, 31 percent have an active traffic control device (such as gates or flashing lights), and the remaining 55 percent have a passive traffic control device (such as crossbucks). Types of traffic control devices are illustrated on page 30. Each day, there are over 11 million vehicles that cross a rail line in Iowa (see Table 2).

Figure 3 – Railroads With Less Than 100 Crossings in Iowa

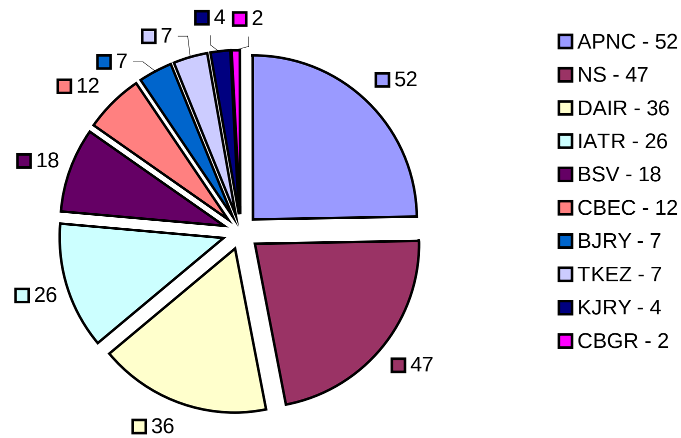


Table 2 – Number of Vehicle Crossings by Traffic Control Device

Traffic Control Device	Vehicles per Day	Number of Crossings	Average Vehicles per Crossing
Passive	1,702,800	3,101	549
Flashing Lights	2,892,700	955	3,029
Gates	1,429,000	783	1,825
Separations	5,021,200	756	6,642
Total	11,045,700	5,595	1,974

Union Pacific Corridor

Service

The UP Corridor is 334 miles long from river to river (see Map 1). The line is double tracked and provides a direct route between Chicago and the western United States. Traffic is interchanged with other railroads at Clinton and Cedar Rapids. Additionally, traffic is moved between the UP Corridor and other UP rail lines at Marshalltown, Nevada, Ames, Grand Junction, Missouri Valley and California Junction.

There are two subdivisions of the UP line west of Missouri Valley—Blair and Omaha. Blair Subdivision traffic moves due west from Missouri Valley through Blair and on to Fremont, Nebraska. Omaha Subdivision traffic moves east from Fremont to Missouri Valley through Council Bluffs. Train traffic is about evenly split between these subdivisions. The northerly Blair Subdivision is included in the study. However, the southerly Omaha Subdivision is not included. This southerly line is about 27 miles longer and has 33 eastbound trains moving through the Omaha-Council Bluffs metropolitan area.

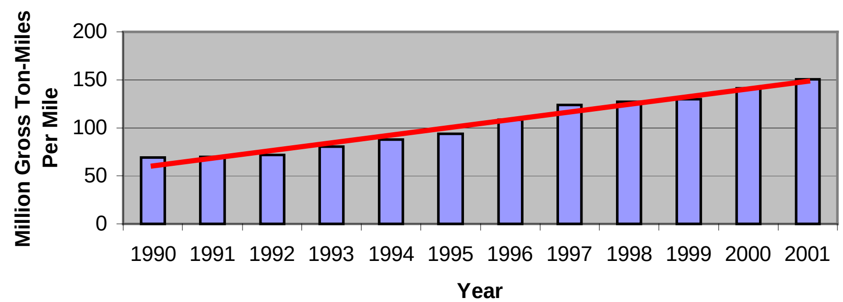
The UP Corridor is a key route of the UP system. The UP is one of the largest railroads in the United States, operating just over 33,000 miles in 23 states in the western two-thirds of the country. UP operations link major west coast and Gulf ports with major gateways to the east including Chicago. The UP has access to the coal-rich Powder River Basin in Wyoming.

Rail service in Iowa is dominated by the UP. They account for 38 percent of the mileage, 44 percent of the total tons moved, and nearly 60 percent of the gross ton-miles in Iowa.

Traffic

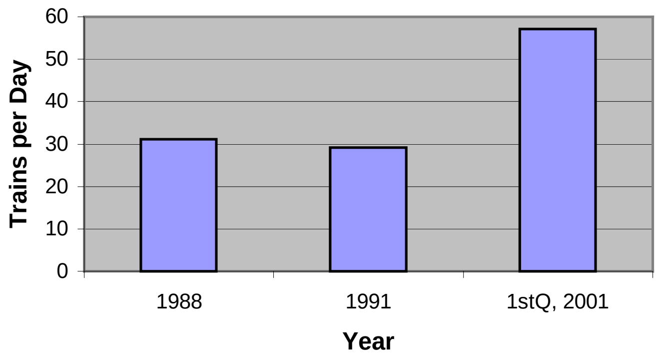
Density on rail lines is measured in terms of gross ton-miles per mile and includes both the weight of the goods and the weight of the cars and locomotives. The UP Corridor is the busiest in the state. Its average density has more than doubled during the last 10 years primarily as a result of the increased through traffic moving over the line (see Figure 4). In 2001, the average density was 151 million gross ton-miles compared to 69 million gross ton-miles in 1990.

Figure 4 – UP Corridor Density



Train movements on the corridor averaged nearly 60 trains per day during the first quarter of 2001. This is twice the average number of trains per day that moved in 1988 and 1991 (see Figure 5). Although the number of trains varies day to day, at any given time about 18 trains are operating on this corridor in Iowa. These 18 trains, illustrated in Map 2, have been spread out across the state for illustration purposes and are not intended to represent actual rail operations. Based on recent information collected at Boone and Ogden, approximately 50 percent were coal trains, 25 percent were intermodal, and 25 percent were mixed freight trains. Most trains were between 90 and 150 cars long.

Figure 5 – UP Corridor Trains Per Day



The UP has taken exception with the forecasts showing an increase to 100-plus trains per day. They have said there would have to be a huge diversion from highway to rail to achieve this increase. While the UP doesn't estimate future traffic levels on specific lines, increases above the 60 trains per day will depend on future economic trends and operational considerations such as routing assignments.

Several crossing studies project that the trains per day will increase in the future on the UP line in central Iowa. These include:

- A UP crossing study prepared for Ogden in September 1999 stated "Approximately 70 trains per day pass through the City of Ogden on the UP Railroad. Train traffic is expected to increase approximately five percent per year for the foreseeable future."
- Information provided in the executive summary of the UP crossing study done for Dayton Avenue in Ames dated September 2000 shows there are 66 trains per day in 1999, increasing to 120 trains per day in the projected year 2019.
- A grade separation feasibility study for the city of Boone completed in March 2002 stated "Due to construction of a second main line track in western Iowa, train volumes are expected to reach 100 trains per day in the future."

Photo 2 – UP Locomotives

Map 2 – UP Corridor Train Traffic

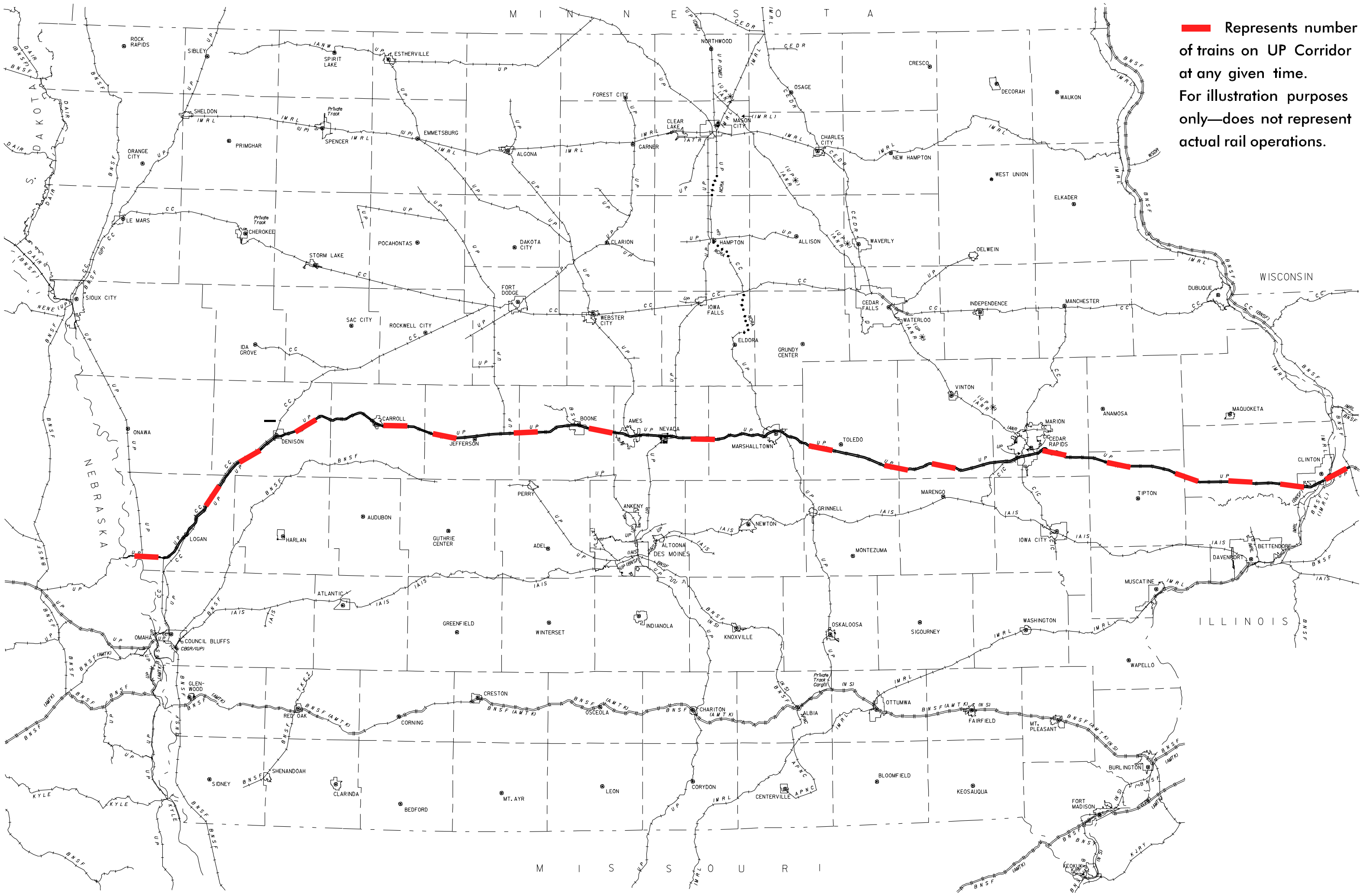


Figure 6 – Crossings in Urban Areas (Population > 5,000)

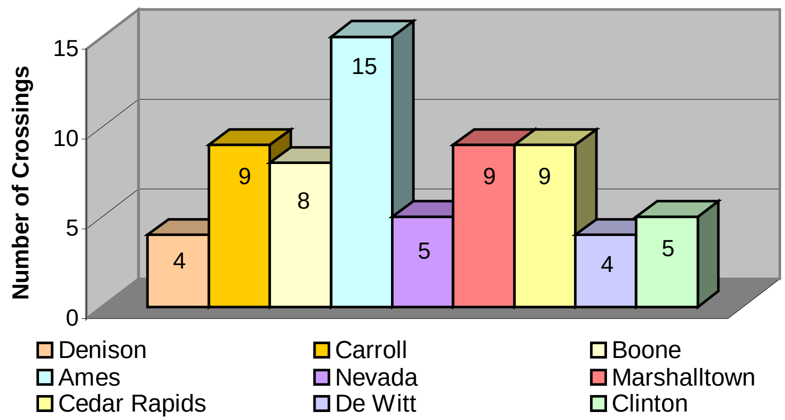
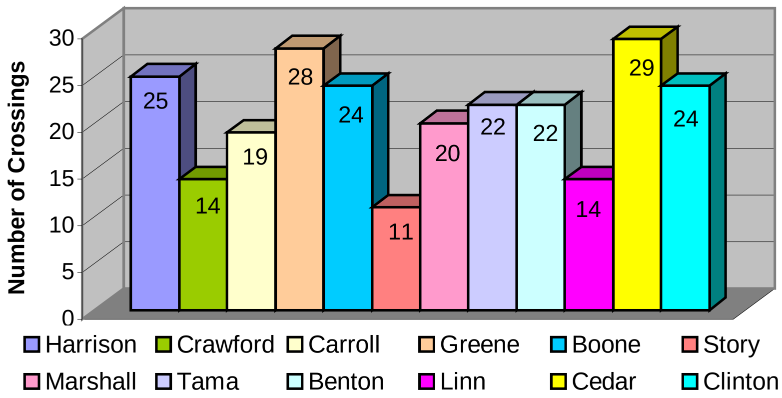


Figure 7 – Crossings in Rural Areas



Crossings

There are 320 rail-highway crossings located on the UP Corridor in the state of Iowa. Of these 320 crossings, 58 are separated, 193 have gates, five have flashing lights, and 64 have passive traffic control devices. There are 24 highway underpasses or overpasses located on the Primary Highway System and 34 located on city streets.

The line passes through 12 counties and nine urban areas with a population over 5,000. The number of crossings per urban area averages 7.5 crossings. Of the nine urban areas, Ames has 15 crossings, the most among the urban areas (see Figure 6). At the low end, Denison and De Witt have just four crossings each.

Crossings per county in rural areas are shown in Figure 7. There are 21 crossings per county on average, ranging from 11 in Story County to 29 in Cedar County.

More detailed information about each crossing located on the UP Corridor is contained in Appendix A.

Highway Structures Over Rail

Out of the 320 rail-highway crossings on the UP Corridor, there are a total of 65 highway structures located at 58 crossings. At seven of these 58 crossings, two separate structures exist (this occurs at divided Interstate or U.S. highway crossings). Of the 65 total structures, 44 are highways over rail, and 21 are rail structures over highways. A Structure Inventory and Assessment (SI&A) rating indicating the structure's capability to safely accommodate traffic volumes and truck loading is developed by the department for each highway structure. The department does not collect data on the 21 rail structures.

Table 3 lists each of the 44 structures. The average age of these structures is 39 years; ranging from four years to 102 years.

Six of the structures are eligible for rehabilitation based on being either structurally deficient or functionally obsolete and having an SI&A rating less than 80. The SI&A rating reflects the condition of the structure and has a scale ranging from 0 to 100, with 0 being the poorest rating and 100 reflecting the best condition. Nine of the structures are eligible for reconstruction based on being structurally deficient or functionally obsolete and having an SI&A rating less than 50—the reconstruction group is in worse condition than the rehabilitation group.

Photo 3 – ID Number 78

Photo 4 – ID Number 112

Table 3 – Highway Structures Over the UP Corridor

ID Number	FRA Number	Location	Street/Road-Highway	Structure Age	Eligible for Rehabilitation	Eligible for Reconstruction	ID Number	FRA Number	Location	Street/Road-Highway	Structure Age	Eligible for Rehabilitation	Eligible for Reconstruction
6	191185J	Harrison County	I-29 SOUTH	35			194	192032J	Tama County	B AVE	82		Yes
6	191185J	Harrison County	I-29 NORTH	35			198	190606P	Tama County	330TH ST	9		
8	191183V	Harrison County	ERIE ST-US 30	4			221	190574L	Benton County	LUZERNE ST	102		Yes
14	191058H	Harrison County	US 30	29	Yes		238	190539X	Linn County	WILLIAMS BLVD-US 151	41	Yes	
32	190996E	Denison	US 30 SOUTH	40			243	190530L	Cedar Rapids	6TH ST	54		Yes
32	190996E	Denison	US 30 NORTH	40			244	200120T	Cedar Rapids	I-380 SOUTH	28		
35	190988M	Denison	DONNA REED RD	8			244	200120T	Cedar Rapids	I-380 NORTH	28		
40	190796V	Crawford County	US 30	75			246	190528K	Cedar Rapids	BOWLING ST	22		
54	190779E	Carroll	US 30	20			248	190479R	Cedar Rapids	US 151 SOUTH	38		
56	190776J	Carroll	LINCOLN ST-US 71	14			248	190479R	Cedar Rapids	US 151 NORTH	4		
78	190744D	Greene County	LOCUST ST-IA 25	15			253	190474G	Linn County	1ST ST	33		
98	190338G	Greene County	220TH ST-US 30	45			254	190473A	Linn County	N 10TH AVE	87		Yes
104	190331J	Boone County	D AVE-US 169	18			293	190405Y	Clinton County	US 30	47		
112	190319C	Boone County	J AVE	102		Yes	305	200119Y	Clinton County	US 30 SOUTH	32		
115	190315A	Boone County	L AVE	102		Yes	305	200119Y	Clinton County	US 30 NORTH	32	Yes	
136	190710J	Ames	MINNESOTA AVE	22	Yes		312	200118S	Clinton County	US 30 SOUTH	28		
147	190699L	Ames	I-35 SOUTH	36			312	200118S	Clinton County	US 30 NORTH	28		
147	190699L	Ames	I-35 NORTH	36			321	190369F	Clinton	WASHINGTON BLVD-US 67	24		
176	190660H	Marshall County	LINCOLN WAY	31									
180	190624M	Marshalltown	S 3RD ST	18									
182	190622Y	Marshalltown	CENTER ST	51									
183	190621S	Marshalltown	S 3RD AVE-IA 14	17									
185	200129E	Marshalltown	S 18TH AVE	22									
189	190615N	Marshall County	YATES AVE	102		Yes			Total: 44				
190	190614G	Marshall County	240TH ST-US 30	48		Yes							
192	190612T	Marshall County	WEBSTER ST	62		Yes							

County and Urban Area Crossing Inventory

The department maintains an inventory of all public rail-highway crossings in the state. This inventory was used as the basis for the UP Corridor Study.

Explanation of Inventory Fields

The following explanation refers to the data fields used in the rail-highway crossing inventory in Appendix A.

ID Number: Identification number used to locate the crossing on the corresponding map.

FRA Number: Identification number assigned by the Federal Railroad Administration.

Street/Road-Highway: Name of the street, road and/or highway the crossing is located across.

Traffic Control Device: The type of warning device located at the crossing.

Speed: Speed of the train as supplied by the rail company.

Number of Trains: Number of trains per day, according to the rail company.

Collisions: Number of collisions at the crossing from 1996-2001, according to the FRA.

Collision Deaths: Number of collision deaths at the crossing from 1996-2001, according to the FRA.

AADT: Average annual daily traffic of the roadway as published in the 2000 traffic book.

Surface Type: Type of surface of the roadway.

Posted Speed Limit: The posted speed limit of the roadway.

Calculated Fields

Predicted Accidents

This is a value established for comparison purposes for a crossing utilizing highway traffic, train traffic, number of main tracks, number of through trains per day, whether the highway is paved, maximum timetable speed, and number of highway lanes. These are adjusted by the number of accidents at the crossing within the past five years and then ranked accordingly. A crossing with a final predicted accident rate of 0.075 or above is a candidate for traffic control device upgrade.

The department uses the FRA's two-step predicted accident formula. The first step is calculating the basic predicted accident level with the following formula:

$$A = K \times EI \times DT \times MS \times MT \times HP \times HL$$

A = basic predicted accident level

K = formula constant

EI = number of highway vehicles per day times the number of trains per day

DT = factor which varies according to the number of trains during the day
MS = factor which varies according to the maximum train timetable speed
MT = factor which varies according to the number of main train tracks
HP = factor which varies according to whether or not the highway is paved
HL = factor which varies according to the number of highway lanes

Different formula constants and factors are used for each of the three traffic control device classes: passive, flashing lights, and gates.

The second step is to adjust the basic predicted accident level to account for the number of rail-highway crossing collisions over the past five-year period and FRA's adjustment values.

Factoid: Passenger trains run an average of 10 miles per hour faster than freight trains.

Example Calculation for Kellogg Avenue in Ames

K = 0.0005745 (FRA formula constant for gates with flashing lights)

EI = 67.78 (FRA value representing a level of 343,200 which is the total of 5,200 ADT times 66 trains. FRA formula includes through trains and all switches)

DT = 2.51(FRA value for 29 day through trains)

MS = 1.00 (FRA value for 40 mph timetable speed)

MT = 1.35 (FRA value for two main tracks)

HP = 1.00 (FRA value for Kellogg being paved)

HL = 1.53 (FRA value for Kellogg being four lanes)

For Step 1:

A = 0.0005745 x 67.78 x 2.51 x 1.00 x 1.35 x 1.00 x 1.53
A = 0.2018

For Step 2:

Kellogg had no accidents during the past five years, resulting in the final value being 0.0498 after the adjustment. Thus, the Predicted Accident rate for Kellogg Avenue is 0.0498. This is below the 0.075 threshold value required in order for a rail-highway grade crossing to be considered as a possible candidate for upgrade of traffic control devices.

Exposure

This is a value established for comparison purposes for a crossing utilizing characteristics such as highway traffic, train traffic, angle of crossing, train speed, and number of rail lines. This is an important statistic affecting the occurrence of accidents at rail-highway grade crossings. An exposure quantifies the interaction between railroad and highway traffic and provides a base for assessing trends in crossing safety. A higher exposure indicates a higher potential for train-vehicle collisions.

Another formula developed by the FRA is used by the department in calculating exposure to account for additional rail-highway crossing characteristics. The formula is:

E = AADT x NT x AF x TS x NL

E = exposure

AADT = average annual daily highway traffic

NT = number of through trains and switching trains per day

AF = factor which varies according to the degree of angle crossing

TS = factor which varies according to speed of the train

NL = factor which varies according to the number of main line tracks

Example Calculation for Duff Avenue in Ames

AADT = 14,500

NT = 62 (FRA formula includes all through trains and one half of the switching trains)

AF = 1.0 (FRA value for angle between 60 and 90 degrees)

TS = 0.9 (FRA value for train speed of 40 mph)

NL = 1.00 (FRA value for two main line tracks)

E = 14,500 x 62 x 1.0 x 0.9 x 1.00

E = 809,100 for Duff Avenue in Ames. As later described on page 38, this rating is the highest in this study, which indicates a high priority for further analysis.

The crossing inventory, which includes a predicted accident and exposure rating for each crossing along the UP Corridor, is shown in Appendix A by county and urban area with population over 5,000.

City Crossing Information

There are 44 cities located along the UP Corridor. These include nine urban areas with populations over 5,000.

There are a total of 123 rail-highway crossings and 33 grade separations in the cities located along the corridor.

Table 4 – Cities Located on UP Corridor

City	2000 Population	Crossings	Separations	City	2000 Population	Crossings	Separations
Ames	50,731	7	8	Jefferson	4,626	6	0
Arion	136	1	0	Le Grand	883	1	1
Belle Plaine	2,878	3	1	Lisbon	1,898	2	0
Bertram	681	2	0	Logan	1,545	1	1
Blairstown	682	2	0	Low Moor	240	1	0
Boone	12,803	7	1	Lowden	794	2	0
Calamus	394	2	0	Luzerne	105	0	1
Camanche	4,215	2	1	Marshalltown	26,009	5	4
Carroll	10,106	7	2	Mechanicsville	1,173	2	0
Cedar Rapids	120,758	5	4	Montour	285	2	0
Chelsea	287	2	0	Mount Vernon	3,390	2	2
Clarence	1,008	3	0	Nevada	6,658	4	1
Clinton	27,772	4	1	Norway	601	2	0
Colo	868	2	0	Ogden	2,023	4	0
De Witt	5,049	3	1	Ralston	98	2	0
Denison	7,339	2	2	Scranton	604	1	1
Dow City	503	2	0	Stanwood	680	3	0
Dunlap	1,139	2	0	State Center	1,349	4	0
Fairfax	889	1	1	Tama	2,731	5	0
Glidden	1,253	2	0	Westside	327	1	0
Grand Junction	964	4	0	Wheatland	772	2	0
Grand Mound	676	3	0	Woodbine	1,564	3	0
				Total: 44		123	33

Union Pacific Corridor Count Data

In order to gain more information and a better understanding of the UP Corridor operations, it was decided to select one urban area for additional data collection. This data collection was conducted in Ames because of its central location in the state and a limited study time schedule. An automatic counter was used to count the number of trains and time of day trains traveled through Ames. These counts were conducted for approximately one month. In addition, pedestrians and trespassers crossing the UP Corridor in Ames were counted. For this study, trespassers are identified as individuals who do not cross at a designated pedestrian crossing.

Data Collection

Data was collected using several different methods. The automated equipment was infrared counters. One counter was used to count trains in downtown Ames and another to count pedestrians at Duff Avenue and Hazel Avenue.

Photo 5 – Infrared Counter

Photo 6 – Pedestrian and Trespasser Counter

To count trespassers, equipment was mounted next to an obvious existing trespasser path between Kellogg and Duff Avenues. To verify the data, a person was also stationed along the rail corridor and had a sight distance of the downtown area between the three intersections of Clark, Kellogg and Duff Avenues.

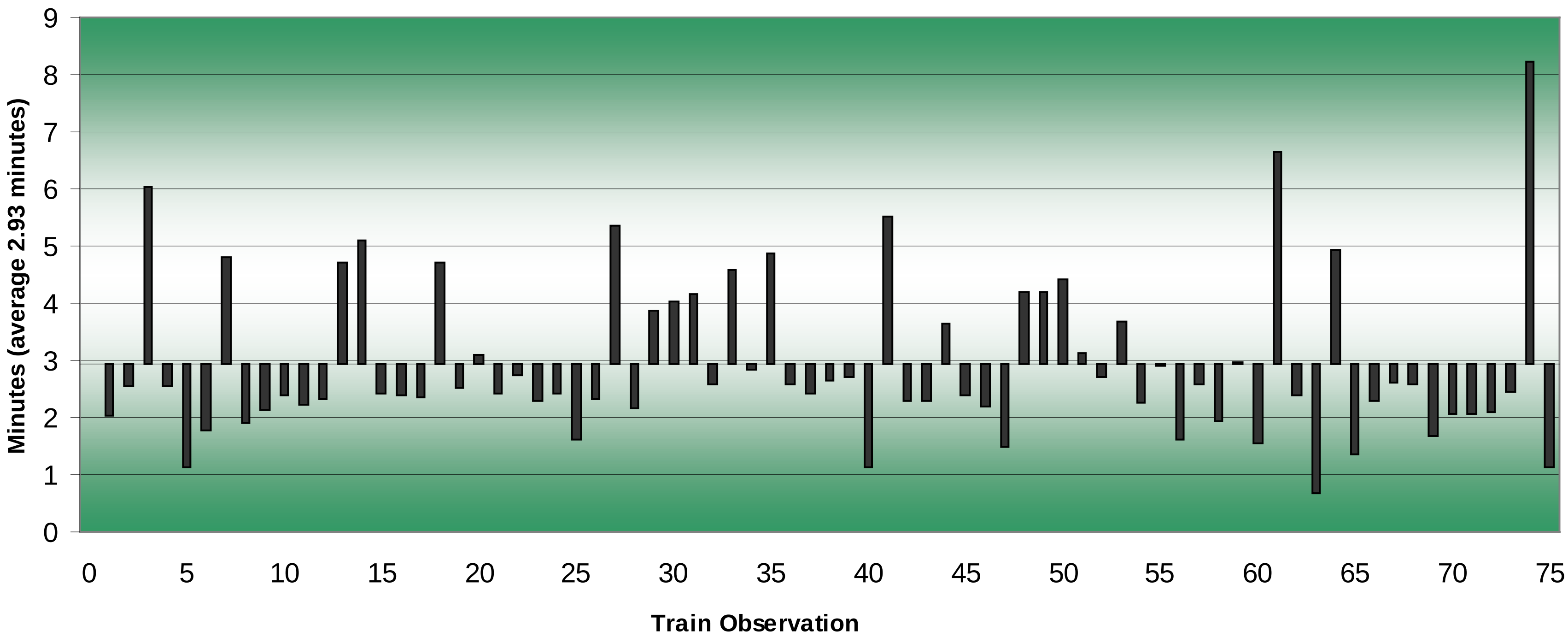
Vehicle Delays at Crossings

Seventy-five trains were randomly counted and timed with a stopwatch in downtown Ames between April 10 and May 14, 2002. During this period, the average time for a train to pass a given point was 146 seconds (2.43 minutes). It took 20 seconds for the train to enter the crossing after the lights started flashing. Ten seconds after the train passed, the gates went up and the crossing was open to vehicular traffic.

On average, a typical crossing in Ames was closed a total of 176 seconds (2.93 minutes)--which is comprised of 146 seconds train time plus 20 seconds warning time plus 10 seconds clearing time. However, as noted in Figure 8, the time for crossings to be closed in downtown Ames was somewhat sporadic—with closing times varying from less than one minute to over eight minutes.

The standard deviation for the time required for these 75 trains was 83 seconds. Eighty-four percent of the time a typical crossing in Ames will be closed for 259 seconds (4.32 minutes) or less, and 16 percent of the time a crossing will be closed for more than 4.32 minutes.

Figure 8 – Minutes With Gate Down Per Train

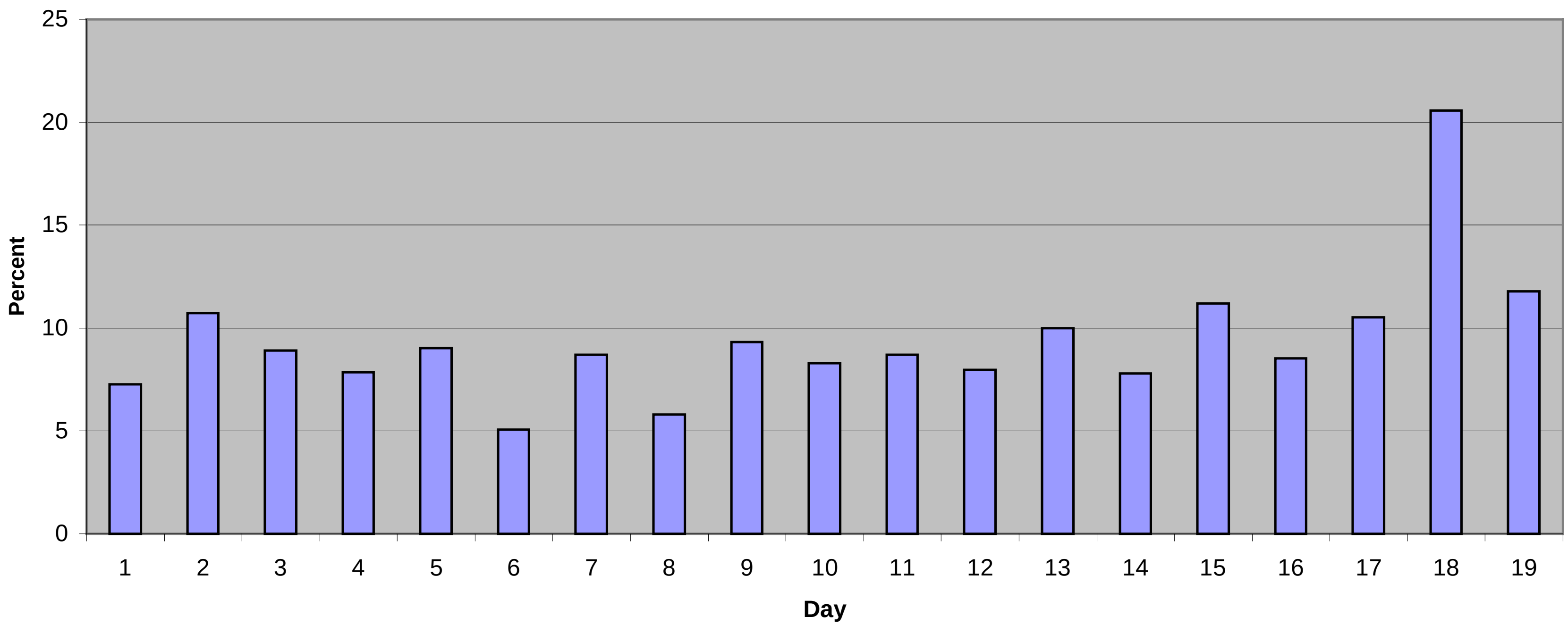


As noted in Figure 9, the average time the downtown crossings in Ames were closed to highway vehicle traffic was slightly over two hours (almost 9 percent) per day. On one particular Sunday, 100 trains passed through Ames, closing each crossing to highway vehicle traffic for approximately five hours (21 percent). When Figure 9 is considered in combination with the length of gate closings shown in Figure 8, the traveling public, as well as emergency responders, are unsure of potential delay times at these crossings which cause safety concerns.

For example, the main fire station north of the downtown area responds to calls south of the UP tracks, primarily using the Duff Avenue crossing. When a train is present, they experience delays. The alternate route with a separation, Grand Avenue, has many congestion and delay problems. They have experienced shorter delays using Duff Avenue.

Moving the rail switching yards from downtown to east of town has helped alleviate some of the downtown congestion. A new fire station recently constructed in the south part of town should also help. In addition, Mary Greeley Medical Center is adversely affected by these delays. Depending on train speed, time of day, and number of vehicles, using the separated route may not be faster than waiting in traffic.

Figure 9 – Percentage of Time Crossing was Closed



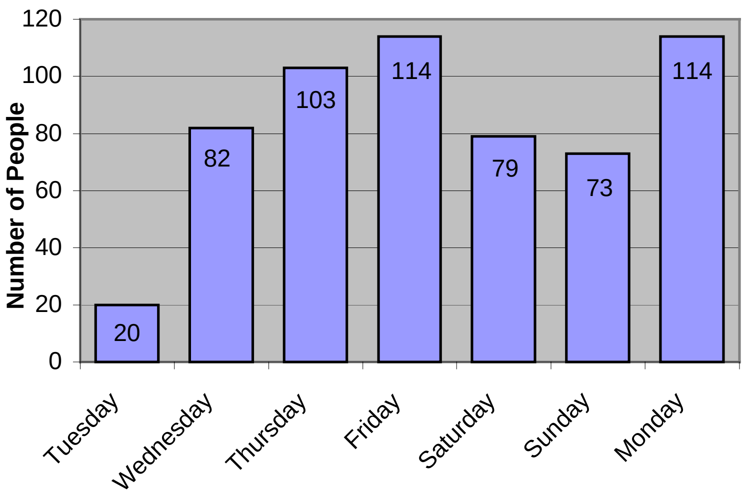
Pedestrians and Trespassers

There is very little existing data concerning the number of pedestrians and trespassers that cross any of the crossings located on the UP Corridor or any other rail-highway crossing in the state.

Pedestrians

An infrared pedestrian counter was stationed at Hazel Avenue and Duff Avenue on the east sidewalk south of the tracks. Approximately 401 pedestrians crossed the Hazel Avenue crossing during a period of 10 days. Nearly 585 pedestrians used the east sidewalk of Duff Avenue during a seven-day period.

Figure 10 – Pedestrians on Duff Avenue

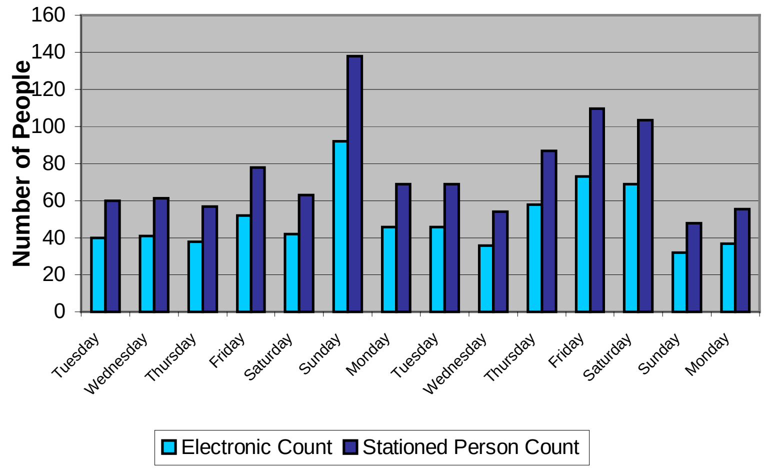


Factoid: According to a police report in the Ames Tribune in late April 2002, there were seven trespassers on UP tracks in downtown Ames over a two-day period. Five were children.

Trespassers

The number of trespassers illegally crossing the UP Corridor in downtown Ames was shocking. Over a 14-day period there were approximately 795 trespassers. An electronic counter at one location conducted this count.

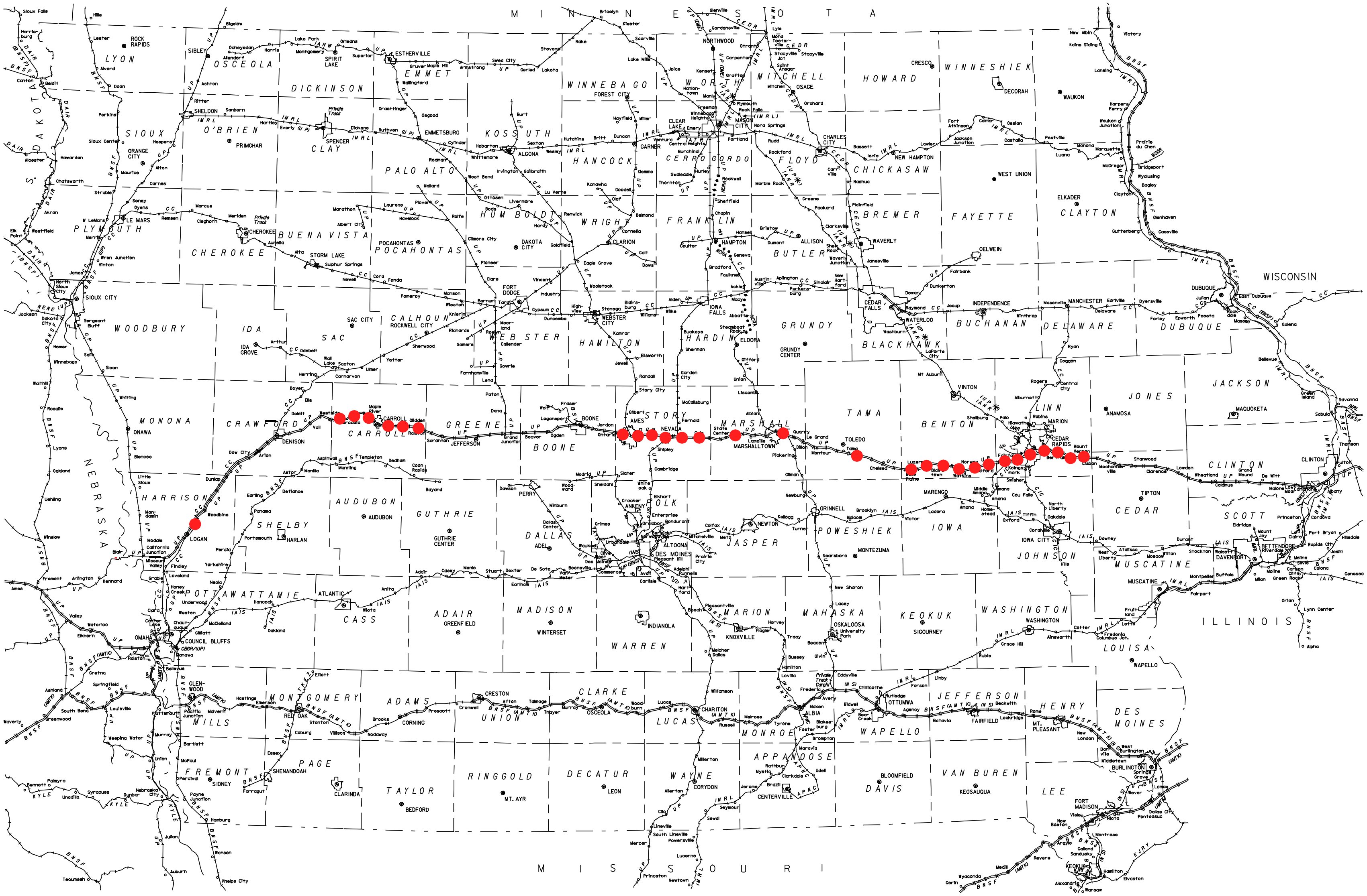
Figure 11 – Trespassers on UP Corridor in Ames



A person was also stationed and able to count all trespassers using areas other than this single location for illegally crossing the UP tracks. The resultant number of trespassers in downtown Ames was 1,053 over a 14-day period, or 75 per day.

There were 29 train-trespasser incidents on the UP Corridor in the 1996 to 2001 time period. The locations by county of these incidents are displayed on Map 3. An incident may include an injury, illness or death.

Map 3 – Train-Trespasser Incidents, 1996-2001



Safety

Train-Vehicle Collisions

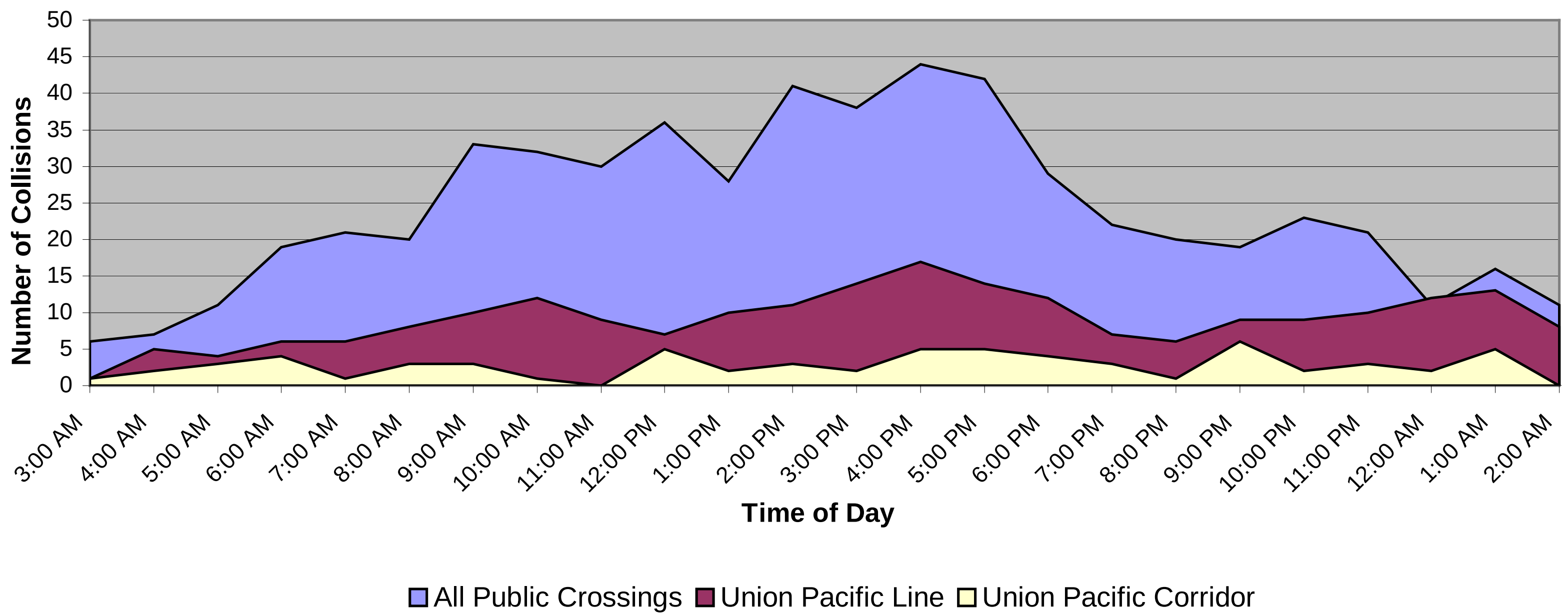
Decreasing the number of collisions between trains and any other form of transportation is a continuing concern for government entities as well as the railroad companies. According to the FRA, there were approximately 580 such collisions during the period of 1996 to 2001 on public roadways in the state of Iowa.

Of these 580 collisions, 66 occurred on the UP Corridor. Collisions on the UP Corridor were consistent with the trends of age, motorist actions, positions of the vehicles, and visibility factors established by all collisions in the state of Iowa.

Drivers under the age of 30 were involved in the most train-vehicle collisions. Approximately 10 drivers were 31 to 50 years old, and nine drivers were 51 to 70 years old. Only one was over the age of 71. The ages of 22 drivers were not reported.

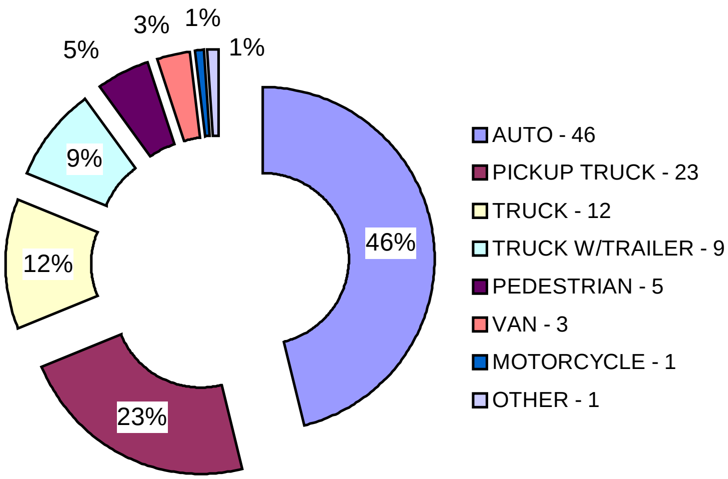
The number of collisions by time of day for all public crossings, the UP line, and the UP Corridor over the last five years is shown in Figure 12. This gives an indication of peak times for train-vehicle collisions in Iowa.

Figure 12 – Collisions in the State of Iowa, 1996-2001



The majority of the vehicles involved in collisions with trains were autos, pickup trucks, trucks, and trucks with trailers rounding out the most frequently involved (see Figure 13). Collisions with pedestrians are also included.

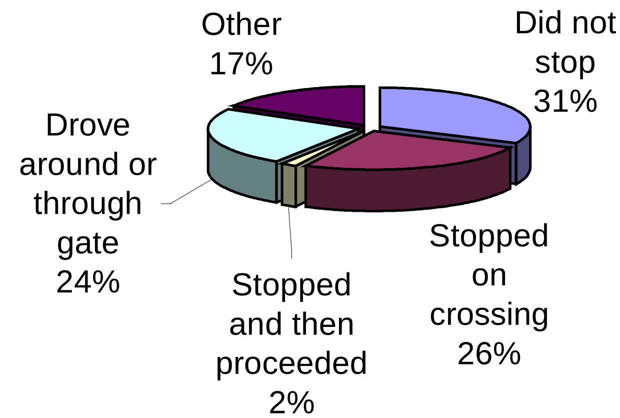
Figure 13 – Type of Vehicle Involved in Collisions on UP Corridor



Total vehicle damage over the past six years was approximately $282,000. As a result of these collisions, many Iowans have also suffered significant medical and financial hardships.

Factoid: Of the 580 collisions in the state of Iowa from 1996 to 2001, 123 involved a female driver, 324 involved a male driver, and for 133 data was not available.

Figure 14 – Action of Motorist Involved in Collisions on UP Corridor



The majority of the collisions occurred during the day in clear conditions with an unobstructed view. A majority (31 percent) of the motorists were moving over the crossing and initially did not stop for traffic control devices. Twenty-six percent stopped on the crossing, 24 percent drove around or through the gate, and two percent stopped and then proceeded (see Figure 14).

Factoid: There were 18 train-vehicle collisions on the UP Corridor that consisted of the vehicle hitting a train. Ten of these collisions were in Boone County--four drove around the gates, and six did not stop.

Figure 15 – United States VMT vs. Collisions

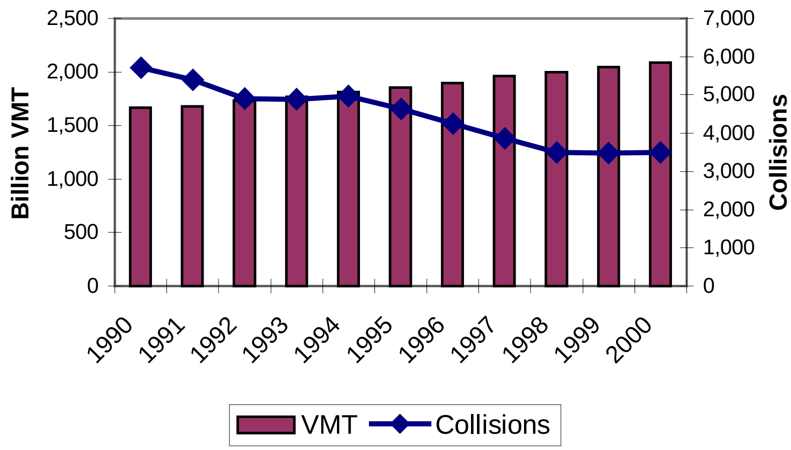


Figure 15 shows the vehicle miles of travel in the United States vs. the number of collisions. Nationally, VMT has continued to grow over the past decade--increasing by over 25 percent from 1,669 billion miles to 2,087 billion miles. During this same time period, rail-highway crossing collisions for all railroads have had a steady downward trend; decreasing by 39 percent from 5,715 to 3,502 annual collisions.

Figure 16 shows the vehicle miles of travel in Iowa vs. the number of collisions. Iowa closely follows the national trend with VMT increasing by 24 percent over the last 10 years from 18.4 billion miles to 22.8 billion miles. The number of collisions in Iowa for all railroads also follows the national trend; decreasing by 42 percent from 189 collisions in 1990 to 109 in 2000.

Figure 16 – Iowa VMT vs. Collisions

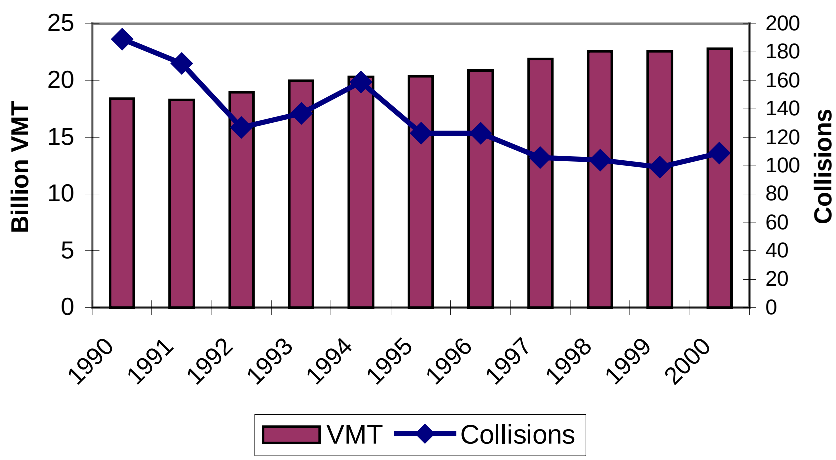


Figure 17 – UP Corridor Collisions

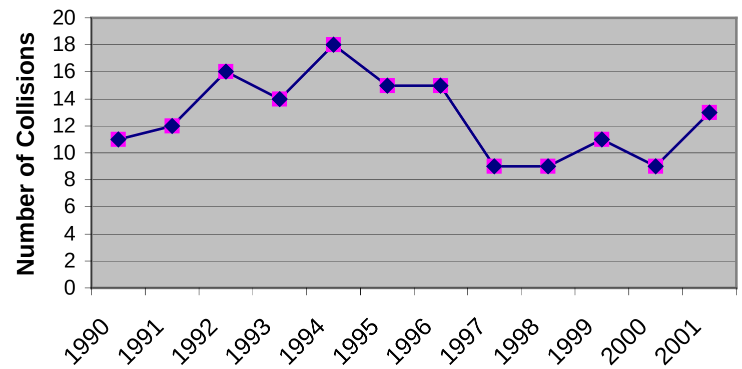


Figure 17 shows the number of collisions on the UP Corridor from 1990 to 2001.

Types of Traffic Control Devices

Photo 7 – Passive (Crossbucks)

Photo 8 – Active (Gates)

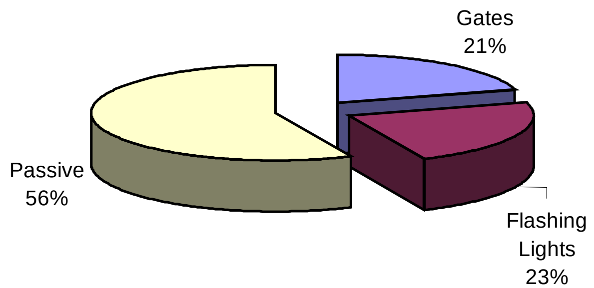
Photo 9 – Active (Flashing Lights)

Photo 10 – Separation

Traffic Control Devices and Collisions

Traffic control devices are the primary mechanism used to notify pedestrians and vehicle operators of the presence of a train. In Iowa there are 756 separated crossings, 783 gated crossings, 955 crossings with flashing lights, and 3,101 crossings with passive traffic control devices.

Figure 18 – Percent of Collisions by Traffic Control Device, State of Iowa

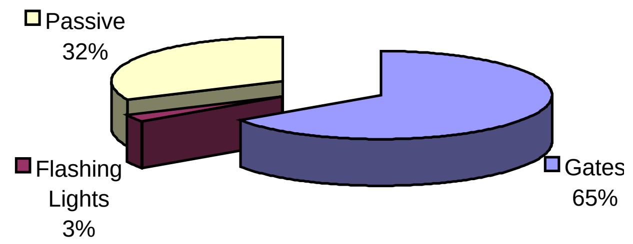


As noted on page 15, crossings on the UP Corridor include 58 separations (36 underpasses and 22 overpasses), 193 with gates, five with flashing lights, and 64 with passive traffic control devices.

Of the 580 collisions in Iowa from 1996 to 2001, none occurred at separated crossings, 116 were at gated crossings, 128 were at crossings with flashing lights, 320 were at crossings that had passive traffic control devices, and 16 were unknown.

Of the 66 collisions that occurred on the UP Corridor from 1996 to 2001, none occurred at separated crossings, 43 were at gated intersections, two were at crossings with flashing lights, and 21 were at crossings that had passive traffic control devices.

Figure 19 – Percent of Collisions by Traffic Control Device, UP Corridor



The percentages of collisions at crossings with passive and gated traffic control devices for the state of Iowa (see Figure 18) are opposite what they are for the UP Corridor (see Figure 19). For passive, it is 56 percent in Iowa vs. 32 percent on the UP Corridor. For gates, it is 21 percent in Iowa vs. 65 percent on the UP Corridor.

Radioactive Hazardous Materials

In the spring of 2002 the Iowa Legislature passed a bill establishing fees on all shipments of radioactive material shipped in waste containers, effective July 1, 2002. Fees are required for both rail and truck shipments. All fees will be used for purposes relating to transporting this type of hazardous material, including enforcement and planning, developing and maintaining a capability for emergency response. The transportation of these materials across the state may be a consideration in the type of traffic control devices to use at crossings, including new grade separations.

Iowa Department of Transportation's Grade Separation Efforts

The department continues to place rail-highway crossing safety as a priority, with grade separations being a viable solution in appropriate situations. Additional funding would be needed since existing sources are limited. Possible sources are discussed in Appendix B.

Several action items have been identified concerning potential grade separations:

- The Iowa Transportation Commission adopted the State Transportation Plan in 1997. This plan included the evaluation (rail and highway traffic volumes, land use, and conflict points) of rail-highway crossings on the Commercial and Industrial Network (CIN) to determine the need for grade separations. The plan recommended 34 grade separations be constructed throughout the state on the CIN as appropriate. One grade separation was at Missouri Valley on the UP Corridor.
- The Iowa Transportation Commission adopted the Rail System Plan in 2000. This document included program guidance concerning investments in rail-highway crossing improvements. Emphasis will continue to be placed on protecting and/or eliminating at-grade crossings where feasible. All CIN crossings will be evaluated to determine the need for grade separations, as well as the appropriate warning devices. Typically, CIN rail-highway crossings will be separated. On the UP Corridor, two at-grade crossings were identified for future upgrading.
- The department provides local government funding through the Traffic Engineering Assistance Program (TEAP). TEAP studies have been conducted in Ames, Boone and Ogden, located on the UP Corridor, to evaluate existing grade crossings and recommend safety improvements, including new grade separations.

Grade Separations

Crossings that have increasing amounts of traffic and trains projected for the future may need to be considered for a grade separation. The number and severity of collisions can be greatly reduced by separating railroad and roadway grades. In some communities it may be advisable to separate grades at one crossing while closing others. A cost-benefit analysis would help in identifying both positive and negative economic impacts and costs associated with these alternatives.

There are no established federal criteria to rely on for the justification of grade separations. However, draft federal guidelines were published in July 2002 with final guidelines expected to be released to the public in the fall of 2002. Many individual states have developed their own criteria or warrants to use when considering grade separation alternatives for a crossing. Some states use a priority index that has to be above a specified value while others use an exposure index as an indicator of when a separation may be justified. Iowa uses an exposure rating based on a formula calculated from train characteristics and vehicular traffic levels.

As primary highway system road projects are being developed, the department thoroughly evaluates each individual crossing to determine whether a grade separation should be constructed. In this process many factors are considered, such as highway traffic levels, number of trains, crossing angle, topography, sight distance, construction costs, community impact, land use, and history of collisions.

Data Analysis

The preliminary analysis of rail-highway crossings on the UP Corridor included the calculation and assessment of three factors: predicted accident rating, exposure, and highway traffic delay for 2002 and 2012.

Evaluating these three factors provides a reasonable indication of which specific crossings should be considered for a grade separation. All 320 rail-highway crossings were evaluated. A predicted accident rating greater than 0.075, an exposure rating greater than 100,000, and a highway vehicle traffic delay greater than five minutes were used to initially screen the crossings. The 54 rail-highway crossings that met at least one of these criteria for 2002 are listed in Table 5.

The predicted accident rating formula and the exposure rating formula are discussed on pages 18 to 20. The determination of highway vehicle traffic delay included calculation of the average length of time the crossing would be closed plus the time required for highway traffic flow to return to normal after a train passed. In summary, the resultant findings are that these 320 crossings are closed to highway vehicle traffic for a total of about 1,000 hours each day. Using an average of 3.7 seconds for the first highway vehicle to clear the crossing and 2.1 seconds for each additional vehicle, the highway vehicle traffic delay was calculated in minutes for each crossing.

Factoid: Activation of traffic control devices must take place for at least 20 seconds prior to the train entering the crossing.

Projecting to 2012

In assessing the need for grade separations, it is essential to evaluate crossing operations using future traffic levels. For the UP Corridor, rural and urban highway traffic levels were projected to 2012 using department highway traffic expansion factors. The number of trains per day was expanded to 80 trains in 2012. (This is a 37 percent increase during the next 10 years—background research indicated this is a realistic mid-range figure.) The number of collisions at each crossing was assumed to remain unchanged.

The predicted accident rating, exposure rating, and highway vehicle traffic delay were recalculated for each crossing in 2012. The 68 rail-highway crossings that met at least one of these criteria are listed in Table 5.

The factor of 0.075 predicted accident rating was used because Iowa DOT Policy Number 500.09 states that a crossing with a final predicted accident rating of 0.075 or above is a candidate for traffic control device upgrade.

The factor of 100,000 exposure was used because past department practice has been to consider the need for a grade separation when this rating was reached. The factor of a highway vehicle traffic delay of five minutes was used because in analyzing the data, the logical statistical cutoff represented this length of time.

Factoid: It takes a school bus or hazardous materials truck about 16 seconds to traverse a crossing after coming to a complete stop as required by Iowa Code.

Table 5 – Crossings That Meet Analysis Criteria

ID Number	FRA Number	Location	Street/Road-Highway	Traffic Control Device	2002			2012		
					Predicted Acc > 0.075	Exposure > 100,000	Traffic Delay > 5 Minutes	Predicted Acc > 0.075	Exposure > 100,000	Traffic Delay > 5 Minutes
2	191189L	Harrison County	AUSTIN AVE	Flashing Lights	X			X		
9	191077M	Missouri Valley	6TH ST-IA 183	Gates		X	X	X	X	X
16	191047V	Harrison County	QUINCY TRL	Passive				X		
19	191044A	Woodbine	LINCOLN WAY	Gates	X	X		X	X	X
25	191023G	Dunlap	IOWA 37	Gates					X	
27	191010F	Dow City	CLARK ST	Passive	X			X		
31	190997L	Crawford County	AIRPORT ST	Gates	X	X		X	X	
33	190992C	Denison	S MAIN ST	Gates		X			X	
45	190789K	Carroll County	DIVISION ST-IA 285	Gates					X	
55	190778X	Carroll	BURGESS RD	Gates					X	
57	190775C	Carroll	CARROLL ST	Gates	X	X		X	X	
58	190774V	Carroll	MAIN ST	Gates		X	X		X	X
59	190773N	Carroll	CLARK ST	Gates	X	X	X	X	X	X
61	190771A	Carroll	GRANT RD	Gates		X			X	X
89	190730V	Jefferson	N ELM ST-IA 4	Gates		X	X		X	X
91	190728U	Jefferson	N CEDAR ST	Gates					X	
96	190340H	Grand Junction	16TH ST	Gates					X	
105	190329H	Ogden	E AVE	Passive				X		
108	190324Y	Ogden	FOURTH ST	Gates					X	
109	190322K	Boone	FIRST ST	Gates		X			X	X
118	190309W	Boone	MARION ST	Gates		X			X	
119	190307H	Boone	DIVISION ST	Gates		X			X	X
122	190301S	Boone	GREENE ST	Gates		X			X	X
123	190300K	Boone	STORY ST	Gates	X	X		X	X	X
125	190723K	Boone County	QUARTZ AVE	Gates					X	
127	190721W	Boone County	S AVE	Passive	X			X		

Table 5 – Crossings That Meet Analysis Criteria, Continued

ID Number	FRA Number	Location	Street/Road-Highway	Traffic Control Device	2002			2012		
					Predicted Acc > 0.075	Exposure > 100,000	Traffic Delay > 5 Minutes	Predicted Acc > 0.075	Exposure > 100,000	Traffic Delay > 5 Minutes
128	190720P	Boone County	T AVE-IA 17	Gates	X	X		X	X	X
132	190715T	Boone County	XL AVE	Passive	X			X		
141	190706U	Ames	HAZEL AVE	Gates		X			X	
143	190704F	Ames	CLARK AVE	Gates		X	X		X	X
144	190703Y	Ames	KELLOGG AVE	Gates		X			X	X
145	190702S	Ames	DUFF AVE	Gates	X	X	X	X	X	X
146	190700D	Ames	DAYTON AVE	Gates		X	X		X	X
152	190694C	Nevada	6TH ST	Gates					X	
154	190692N	Nevada	10TH ST	Gates		X			X	
157	190688Y	Story County	667TH AVE	Passive	X			X		
163	190681B	Story County	730TH AVE	Gates	X			X		
168	190672C	State Center	1ST AVE N	Gates	X	X		X	X	
175	190662W	Marshall County	MARSH AVE-IA 330	Gates		X			X	X
178	190626B	Marshalltown	S 12TH ST	Gates		X			X	
179	190625U	Marshalltown	S 6TH ST	Gates		X	X		X	X
184	190620K	Marshalltown	GOVERNOR RD	Gates	X	X		X	X	X
191	190613A	Le Grand	BEANE ST-IA 146	Gates		X			X	
201	190602M	Tama	STATE ST-US 63	Gates		X	X		X	X
215	190581W	Belle Plaine	7TH AVE-IA 21	Gates	X	X		X	X	X
216	190580P	Belle Plaine	8TH AVE	Gates				X	X	
217	190579V	Belle Plaine	9TH AVE	Gates					X	
224	190569P	Blairstown	LOCUST ST-IA 82	Gates		X			X	X
230	190560D	Benton County	LIBERTY ST	Passive	X			X		
235	190551E	Norway	EUCLID ST	Gates		X			X	X
239	190538R	Fairfax	VANDERBILT ST	Gates					X	
240	190533G	Cedar Rapids	OLD BRIDGE RD	Passive	X			X		
241	190532A	Cedar Rapids	EDGEWOOD RD SW	Gates		X			X	

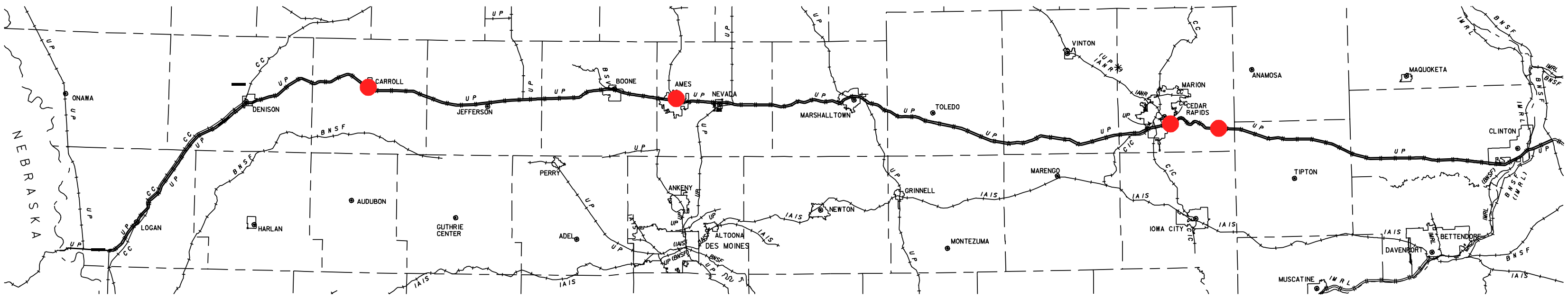
Table 5 – Crossings That Meet Analysis Criteria, Continued

ID Number	FRA Number	Location	Street/Road-Highway	Traffic Control Device	2002			2012		
					Predicted Acc > 0.075	Exposure > 100,000	Traffic Delay > 5 Minutes	Predicted Acc > 0.075	Exposure > 100,000	Traffic Delay > 5 Minutes
245	190529S	Cedar Rapids	J ST SE	Gates	X	X	X	X	X	X
247	190527D	Cedar Rapids	C ST	Gates		X			X	
256	190471L	Mount Vernon	N 1ST AVE-IA 1	Gates	X	X	X	X	X	X
264	190457R	Cedar County	DELTA AVE	Passive	X			X		
266	190453N	Mechanicsville	MADISON ST	Gates		X			X	
267	190452G	Mechanicsville	CHERRY ST	Gates		X			X	
273	190445W	Stanwood	IOWA 38	Gates		X			X	
288	190414X	Lowden	WASHINGTON AVE	Gates		X			X	
292	190406F	Wheatland	TORONTO ST	Gates					X	
296	190400P	Calamus	2ND ST	Gates		X			X	
298	190398R	Clinton County	210 AVE	Flashing Lights	X			X		
301	190395V	Grand Mound	EAST ST	Gates		X			X	
308	190388K	De Witt	6TH AVE	Gates		X	X		X	X
316	190377X	Clinton County	3RD ST	Gates		X			X	
320	190370A	Clinton	7TH AVE	Gates		X			X	

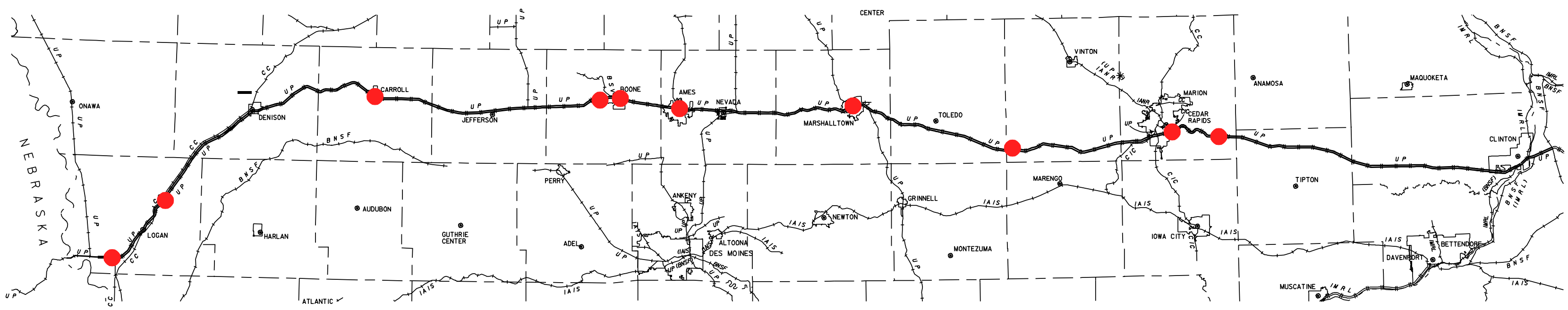
Factoid: Mast-mounted flashing lights must flash alternatively 35 to 65 flashes per minute. The most common bulb is 18 to 25 watts.

Map 4 – Crossings That Meet All Three Analysis Criteria, 2002 and 2012

2002 Crossings



2012 Crossings



Top 10 Crossings

The 10 rail-highway crossings on the UP Corridor (out of the total 320 crossings) with the highest predicted accident ratings are listed in Table 6. These are geographically distributed across the entire corridor. Seven are located in urban areas over 5,000 population, with the remaining three being located in rural areas. These 10 crossings have high predicted accident ratings, ranging from 0.0847 to 0.1245.

Table 6 – Top Ten Highest Predicted Accidents, 2002

ID Number	FRA Number	Location	Street/Road-Highway	Traffic Control Device	Predicted Accidents
19	191044A	Woodbine	LINCOLN WAY	Gates	0.1245
145	190702S	Ames	DUFF AVE	Gates	0.1184
132	190715T	Boone County	XL AVE	Passive	0.1166
31	190997L	Crawford County	AIRPORT ST	Gates	0.1148
215	190581W	Belle Plaine	7TH AVE-IA 21	Gates	0.1026
245	190529S	Cedar Rapids	J ST SE	Gates	0.0930
298	190398R	Clinton County	210 AVE	Flashing Lights	0.0870
123	190300K	Boone	STORY ST	Gates	0.0866
256	190471L	Mount Vernon	N 1ST AVE-IA 1	Gates	0.0855
184	190620K	Marshalltown	GOVERNOR RD	Gates	0.0847

The 10 rail-highway crossings with the highest exposure ratings (out of the total 320 crossings) are listed in Table 7. These include four of the same crossings in the top 10 highest predicted accidents list: Duff Avenue in Ames, 7th Avenue-Iowa 21 in Belle Plaine, J Street SE in Cedar Rapids, and Governor Road in Marshalltown. All top 10 highest exposure crossings are located in urban areas. The exposure ratings are very high, ranging from 282,240 to 809,100.

Table 7 – Top Ten Highest Exposure Ratings, 2002

ID Number	FRA Number	Location	Street/Road-Highway	Traffic Control Device	Exposure
145	190702S	Ames	DUFF AVE	Gates	809,100
146	190700D	Ames	DAYTON AVE	Gates	489,800
89	190730V	Jefferson	N ELM ST-IA 4	Gates	470,400
245	190529S	Cedar Rapids	J ST SE	Gates	398,982
308	190388K	De Witt	6TH AVE	Gates	388,600
143	190704F	Ames	CLARK AVE	Gates	385,020
184	190620K	Marshalltown	GOVERNOR RD	Gates	316,680
215	190581W	Belle Plaine	7TH AVE-IA 21	Gates	295,800
144	190703Y	Ames	KELLOGG AVE	Gates	290,160
58	190774V	Carroll	MAIN ST	Gates	282,240

The 10 rail-highway crossings with the highest traffic delay times (out of the 320 crossings) are listed in Table 8. These include two of the crossings with the highest predicted accident rating and exposure rating. These crossings are Duff Avenue in Ames and J Street SE in Cedar Rapids. North 1st Avenue-Iowa 1 in Mount Vernon is listed in the top 10 highest predicted accidents table, as well as the top 10 highest delay times table.

There are five crossings listed in the highest exposure ratings table and the highest delay times table. These crossings are 6th Avenue in De Witt, Dayton Avenue in Ames, Main Street in Carroll, North Elm Street-Iowa 4 in Jefferson, and Clark Avenue in Ames.

Dayton Avenue in Ames is being reconstructed with a bridge over the UP tracks. Completion is scheduled for late December 2002.

In summary, the crossings listed in two or more tables should be further evaluated.

Table 8 – Top Ten Highest Delay Times, 2002

ID Number	FRA Number	Location	Street/Road-Highway	Traffic Control Device	Seconds Per Through Train	Minutes Per Through Train
145	190702S	Ames	DUFF AVE	Gates	359	6.0
308	190388K	De Witt	6TH AVE	Gates	345	5.7
146	190700D	Ames	DAYTON AVE	Gates	322	5.4
201	190602M	Tama	STATE ST-US 63	Gates	322	5.4
9	191077M	Missouri Valley	6TH ST-IA 183	Gates	319	5.3
58	190774V	Carroll	MAIN ST	Gates	315	5.3
89	190730V	Jefferson	N ELM ST-IA 4	Gates	313	5.2
245	190529S	Cedar Rapids	J ST SE	Gates	313	5.2
143	190704F	Ames	CLARK AVE	Gates	307	5.1
256	190471L	Mount Vernon	N 1ST AVE-IA 1	Gates	307	5.1

Factoid: Gates will return to the upright position 12 seconds after all trains have cleared the crossing.

Findings

As a result of the UP Corridor analysis, nine issues were identified and are addressed on pages 42 to 44. There is a conclusion and recommendation for each issue.

Issues

Data Analysis

1. Data Consistency
2. Crossings with Low Exposure and High Predicted Accident Ratings

Department Practices

1. Guidance for Grade Separation Needs
2. Project Selection for Traffic Control Devices

Crossing Analysis Tools

1. Evaluation Process
2. Corridor Planning
3. Economic Impact Analysis

Public Awareness

1. Trespassing
2. Length of Trains

Findings of Crossing Analysis

The UP Corridor analysis has identified 54 crossings (out of a total of 320 public crossings) that in 2002 meet one or more of the three criteria for predicted accident rating, exposure, and highway traffic delay. In addition, the locations of the top 10 crossings meeting the three criteria have also been identified.

The study has also determined that 14 additional crossings meet one or more of these three criteria based upon 2012 traffic.

Year 2002

1. Four crossings (of the 54 crossings) meet all three evaluation criteria thresholds and should be further evaluated for grade separation.
2. Sixteen crossings (of the 54 crossings) meet two of the three criteria and should be further evaluated. Of those 16, eight crossings have both a predicted accident rating of over 0.075 and an exposure over 100,000 and should be further evaluated for grade separation.
3. Thirty-four crossings (of the 54 crossings) meet one of the criteria and should be further evaluated for warning device upgrade.

Year 2012

1. Ten crossings (of the 68 crossings) meet all three evaluation criteria thresholds and should be further evaluated for grade separation.
2. Nineteen crossings (of the 68 crossings) meet two of the three criteria and should be further evaluated. Of those 19, four crossings have both a predicted accident rating of over 0.075 and an exposure over 100,000 and should be further evaluated for grade separation.
3. Thirty-nine crossings (of the 68 crossings) meet one of the criteria and should be further evaluated for warning device upgrade.

In summary, two of the crossings are identified in all three top 10 listings for 2002. These crossings are of high priority for further study.

Discussion of Issues

Data Analysis

Issue 1 – Data Consistency

Conclusion

Rail-highway crossing data has not been collected on a regular basis. Some data is out of date, with other data being more current. This variation in data age contributes to differences in calculating predicted accidents and exposure values that are used for comparative analyses.

Recommendation

An improved procedure for managing rail-highway crossing inventory data should be established. Guidelines need to be improved to clearly outline when data needs to be collected.

Issue 2 – Crossings with Low Exposure and High Predicted Accident Ratings

Conclusion

The analysis indicates there are some crossings that have low exposure ratings, but very high predicted accident ratings. Eight were identified in this group and all have a history of collisions. This could be caused by a specific problem such as difficulty in detecting trains at the crossing, low light levels, etc. A general cause of collision is usually reported on the accident/incident report form; however, more information related to a collision would be helpful in determining specific problems. Upgrading the type of traffic control devices at these crossings may not correct the problem.

Recommendation

The department should further investigate this group of eight crossings to determine the specific problem. Based on the findings, the department should investigate specific remedies such as traffic control devices that incorporate new technology to address the problem.

Department Practices

Issue 1 – Guidance for Grade Separation Needs

Conclusion

The department does not have clearly established guidance as to when rail-highway separations should be constructed for highway projects.

Recommendation

The department needs to develop guidance for determining grade separation needs. This should be reflected in departmental policies. The department should also consider the use of predicted accident and exposure ratings in the determination of the need for grade separations.

Issue 2 – Project Selection for Traffic Control Devices

Conclusion

Iowa’s rail-highway crossing inventory analysis indicates some additional traffic control device improvements may be needed along the UP Corridor.

Recommendation

The department should continue efforts to assist local entities in the funding application process for rail-highway traffic control device improvements.

Crossing Analysis Tools

Issue 1 – Evaluation Process

Conclusion

The department currently uses predicted accident and exposure rating factors which are based on current year data and are used each year to program improvement funding. There may exist a need for a long-range assessment of rail-highway crossing needs to account for future rail and highway traffic levels.

Recommendation

The department should review the need to establish a long-range assessment of crossing needs in order to maximize limited financial resources directed toward crossing improvements.

Issue 2 – Corridor Planning

Conclusion

With the high level of trespassers, collisions, and the economic delay of travelers and truck traffic on the UP Corridor, crossing safety improvements at one location can directly impact other crossings and how the overall rail-highway system operates.

Recommendation

The department should continue to analyze rail lines in a corridor review process that may be helpful in prioritizing projects. Other highway authorities should initiate a similar review process. The review process should maximize the ability to implement closures.

Issue 3 – Economic Impact Analysis

Conclusion

The average number of trains on the UP Corridor has doubled, and average density has more than doubled over the last 10 years. Growth on this line is expected to continue in the future. This study has initially identified a large number of crossings on the UP Corridor that need further study for improvements that would be beneficial to future growth.

Recommendation

The department should further investigate an acceptable economic impact analysis methodology for use in grade separation studies. The department should study revising the methodology used in selecting projects to include a benefit-cost analysis for crossing improvements. One possible tool is the Federal Railroad Administration's GRADEDEC 2000 computational investment decision tool model.

Public Awareness

Issue 1 – Trespassing

Conclusion

As a result of this study, it has been identified that trespassing on private railroad property is a significant problem. Over the last six years, there were 29 trespasser incidents on the UP Corridor, which include an injury, illness or death.

Recommendation

Current efforts to address this concern (FRA, Operation Lifesaver, railroads, etc.) should continue. Additional efforts should be made to partner with these groups to more aggressively address the problem of trespassing on private railroad property.

Issue 2 – Length of Trains

Conclusion

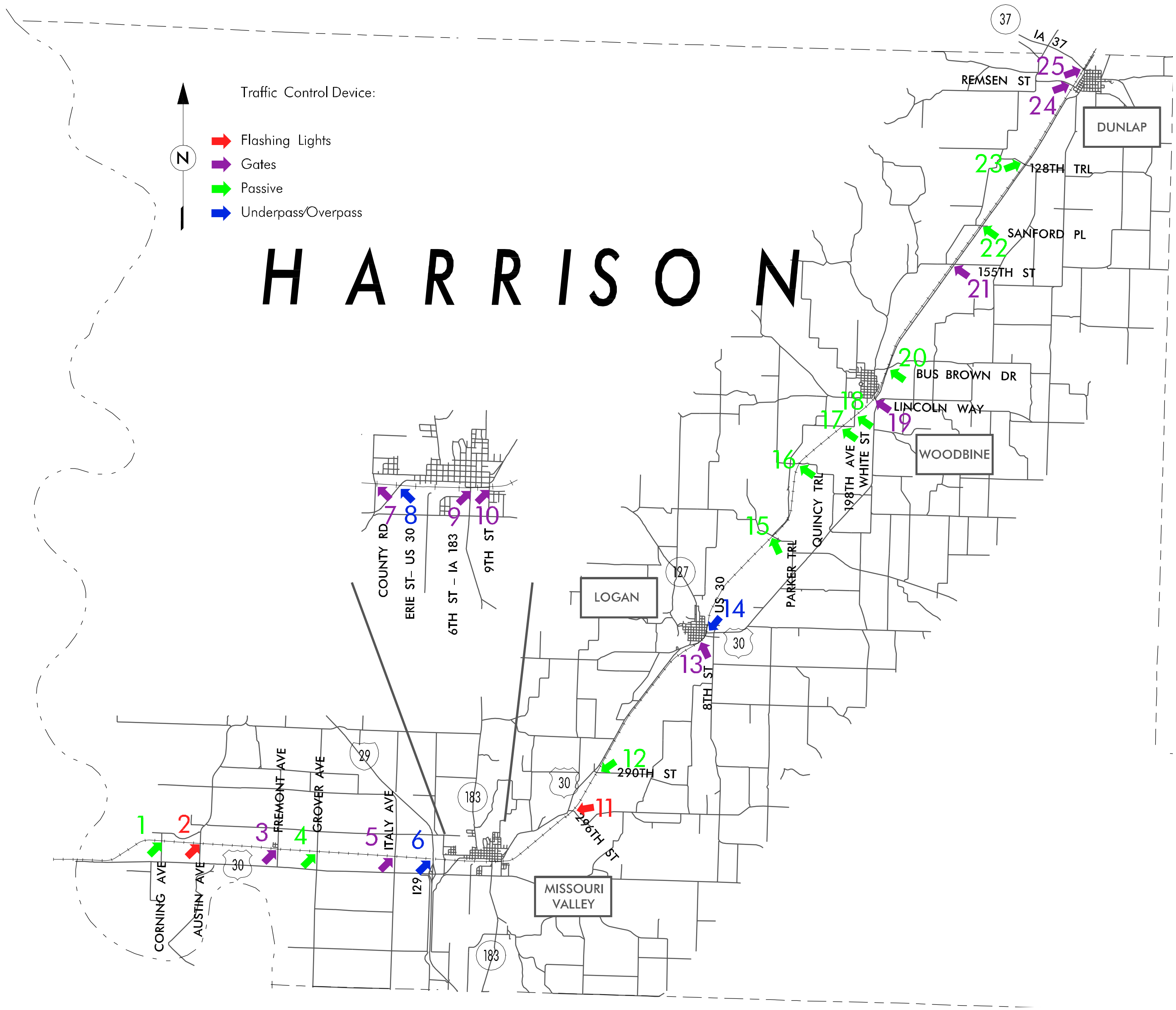
The average number of trains that use the UP Corridor on a daily basis has increased; however, the rate of increase has slowed over the last several years. The trend is towards longer trains and heavier cars; some trains currently have in excess of 150 cars.

Recommendation

Highway authorities should incorporate the number and length of trains on the UP Corridor into their highway and safety improvement programs. This trend in longer trains may result in increased delays at crossings and may influence traffic patterns. These delays may also impact existing businesses and future development.

Appendix A – County and Urban Area Crossing Inventory

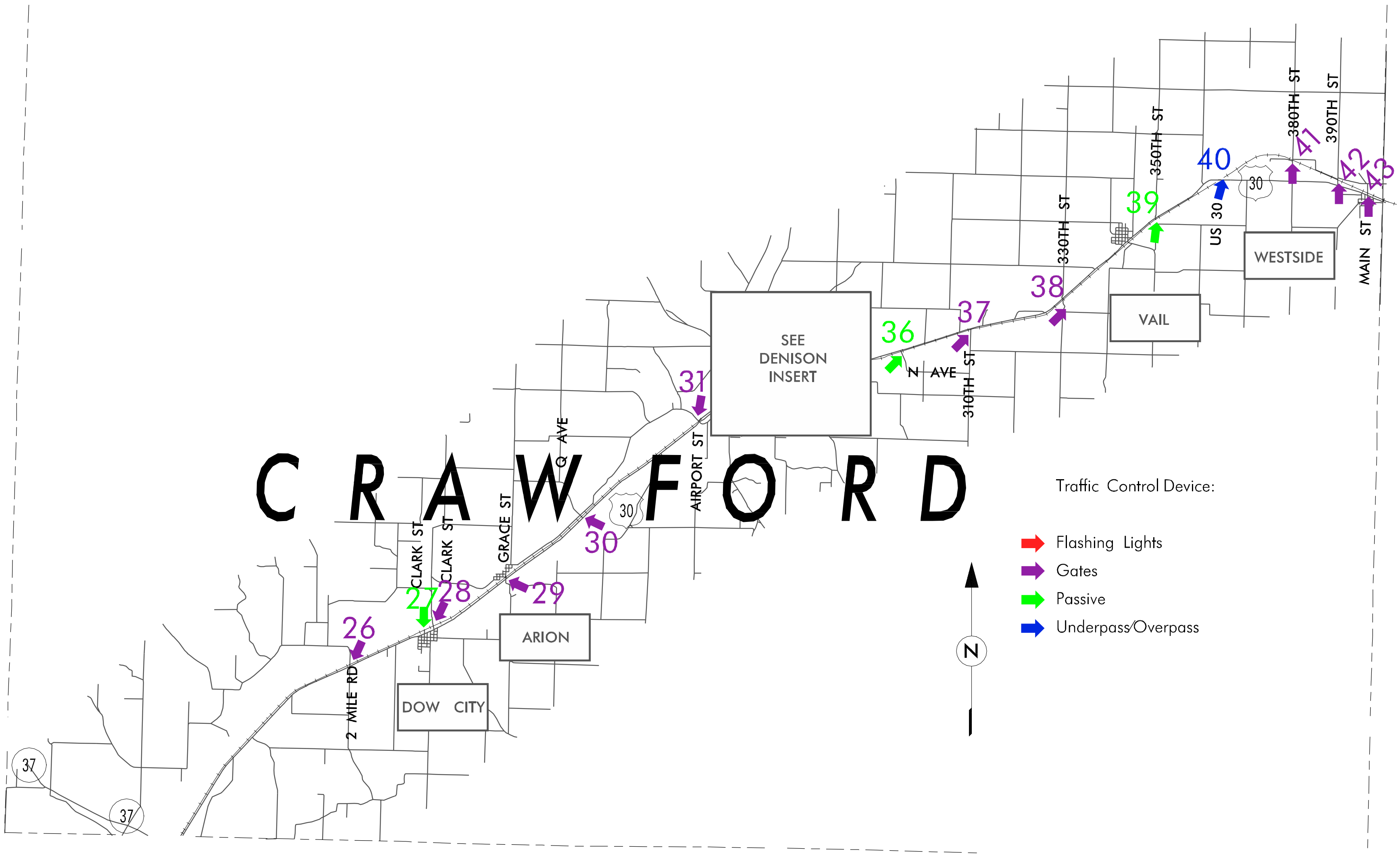
Harrison County Map



Harrison County Rail-Highway Crossings

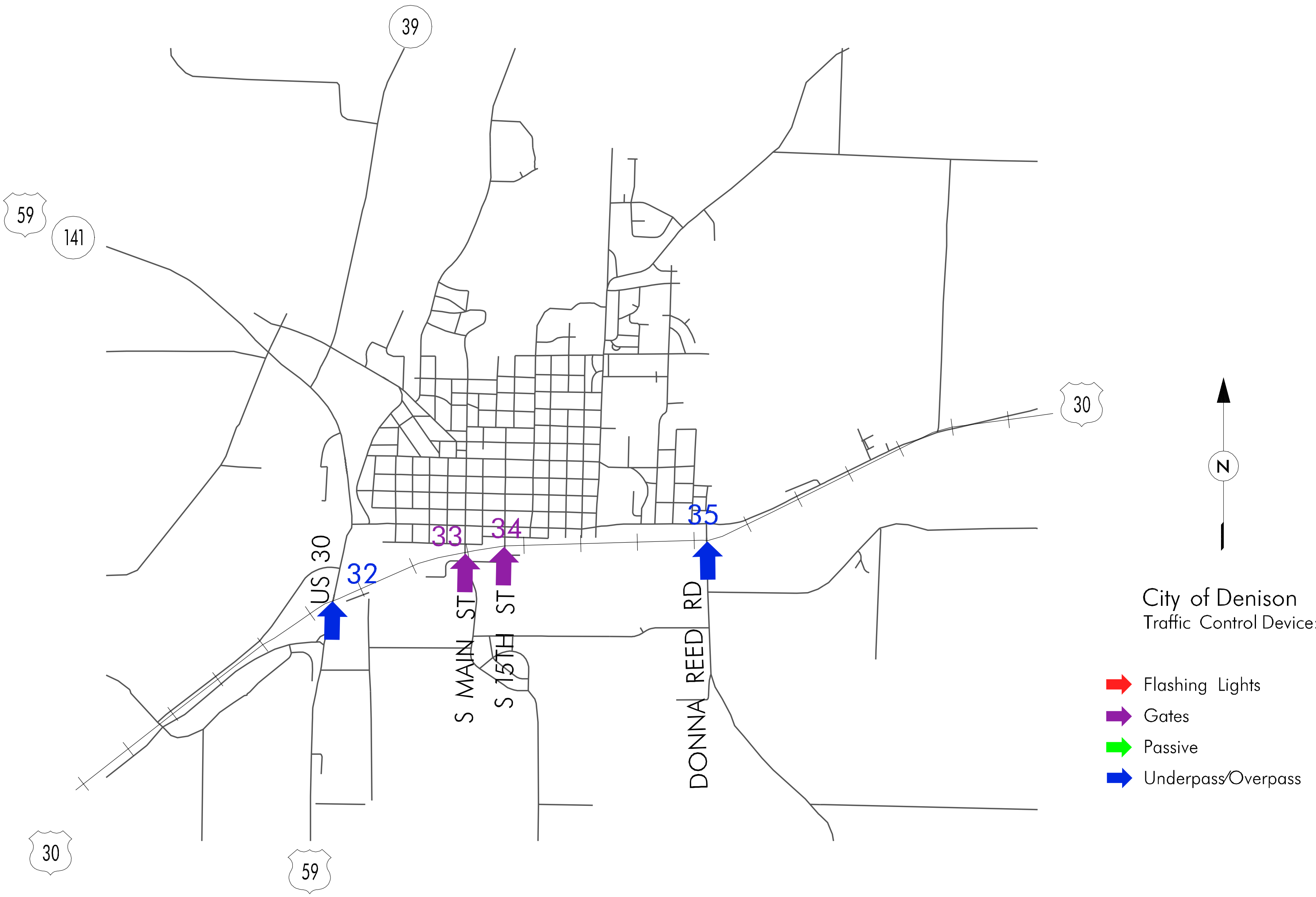
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
1	191190F	CORNING AVE	Passive	70	58			45	Gravel	55	0.0249	2,088
2	191189L	AUSTIN AVE	Flashing Lights	70	58	1		970	Paved	55	0.0855	45,008
3	191188E	FREMONT AVE	Gates	70	58			270	Gravel	55	0.0170	12,528
4	191187X	GROVER AVE	Passive	70	66			25	Dirt	55	0.0162	1,240
5	191186R	ITALY AVE	Gates	70	58			90	Gravel	55	0.0132	5,220
6	191185J	I-29	Underpass	0	0			12,600	Paved	65	0.0000	0
7	191184C	COUNTY RD	Gates	70	58			750	Paved	25	0.0206	36,975
8	191183V	ERIE ST-US 30	Underpass	0	0			8,700	Paved	35	0.0000	0
9	191077M	6TH ST-IA 183	Gates	40	56	1		2,620	Paved	25	0.0743	132,048
10	191074S	9TH ST	Gates	60	56			230	Paved	25	0.0208	12,880
11	191073K	296TH ST	Flashing Lights	70	56			330	Paved	55	0.0414	18,480
12	191071W	290TH ST	Passive	70	56			30	Gravel	55	0.0217	1,680
13	191059P	8TH ST	Gates	50	56			486	Gravel	25	0.0248	24,494
14	191058H	US 30	Underpass	0	0			5,700	Paved	35	0.0000	0
15	191052S	PARKER TRL	Passive	70	56			50	Gravel	55	0.0253	2,800
16	191047V	QUINCY TRL	Passive	70	56	1		40	Gravel	30	0.0712	2,688
17	191046N	198TH AVE	Passive	70	56			80	Gravel	55	0.0268	5,376
18	191045G	WHITE ST	Passive	70	56			70	Gravel	25	0.0279	3,998
19	191044A	LINCOLN WAY	Gates	70	56	2		2,680	Paved	35	0.1245	150,080
20	191043T	BUS BROWN DR	Passive	70	56			1,170	Paved	25	0.0302	65,520
21	191039D	155TH ST	Gates	70	56	1		60	Gravel	55	0.0489	3,360
22	191038W	SANFORD PL	Passive	70	56			90	Gravel	55	0.0303	5,040
23	191033M	128TH TRL	Passive	70	56			50	Gravel	55	0.0225	2,800
24	191029X	REMSEN ST	Gates	70	56			200	Paved	25	0.0200	11,200
25	191023G	IOWA 37	Gates	70	56			1,600	Paved	35	0.0322	89,600

Crawford County Map



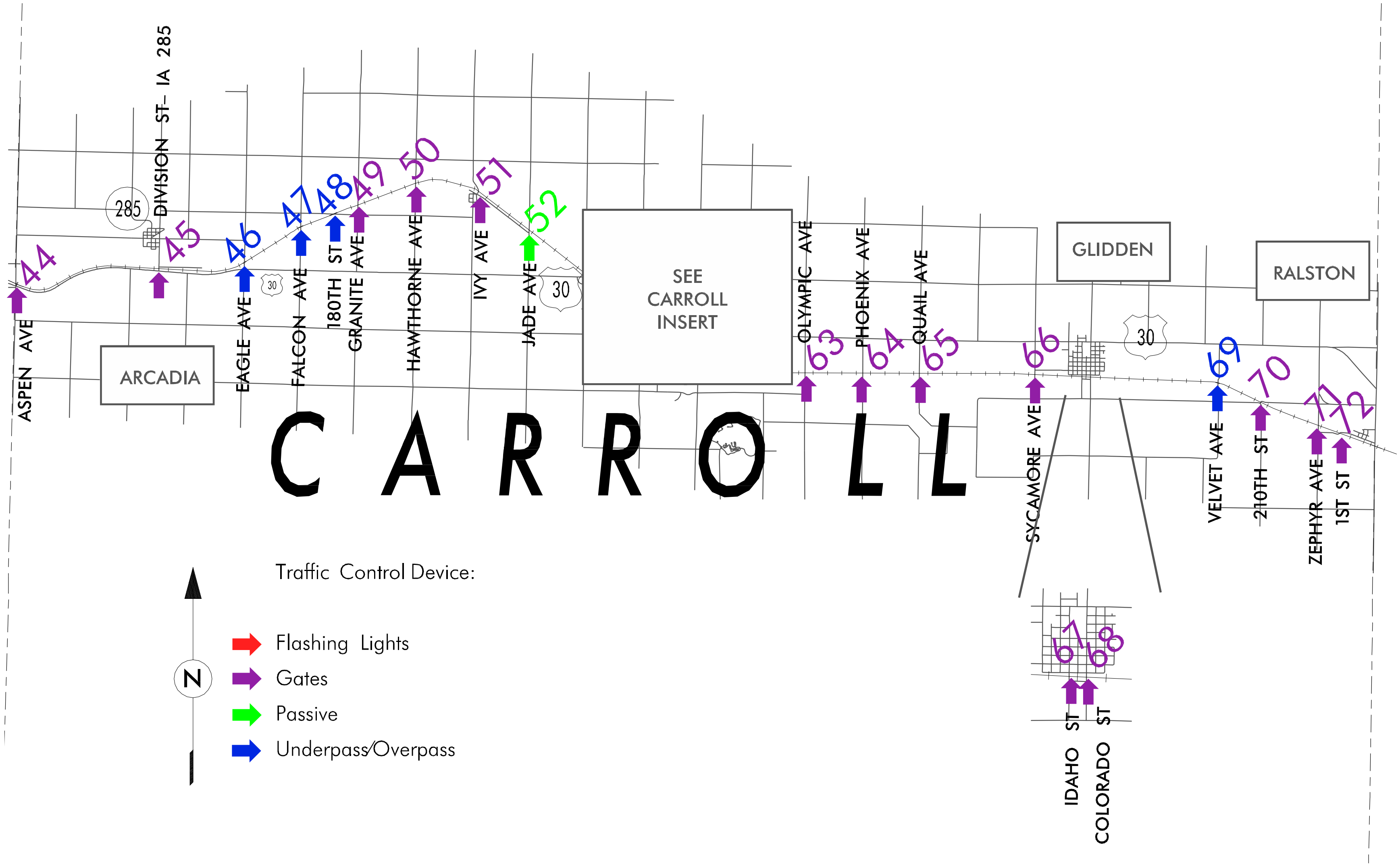
Crawford County Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
						1996-2001						
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	Colli-sions	Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
26	191013B	2 MILE RD	Gates	70	56			250	Gravel	55	0.0178	11,200
27	191010F	CLARK ST	Passive	70	56			880	Paved	45	0.0761	49,280
28	191009L	CLARK ST	Gates	70	56			880	Paved	45	0.0283	49,280
29	191007X	GRACE ST	Gates	70	56			380	Paved	25	0.0236	25,536
30	191005J	Q AVE	Gates	70	56			45	Paved	55	0.0138	2,520
31	190997L	AIRPORT ST	Gates	70	56	2		2,180	Paved	55	0.1148	122,080
36	190983D	N AVE	Passive	70	56			30	Gravel	55	0.0217	1,680
37	190981P	310TH ST	Gates	70	56			100	Gravel	55	0.0159	5,600
38	190975L	330TH ST	Gates	70	56			100	Gravel	55	0.0135	5,600
39	190799R	350TH ST	Passive	70	56			20	Gravel	55	0.0188	1,120
40	190796V	US 30	Underpass	0	0			3,390	Paved	55	0.0000	0
41	190794G	380TH ST	Gates	70	56			40	Gravel	55	0.0129	2,240
42	190792T	390TH ST	Gates	70	56			120	Gravel	55	0.0176	6,720
43	190791L	MAIN ST	Gates	70	56			300	Paved	25	0.0221	16,800

Denison Urban Area Map



Denison Urban Area Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
32	190996E	US 30	Underpass	0	0			9,700	Paved	55	0.0000	0
33	190992C	S MAIN ST	Gates	70	56			2,690	Paved	25	0.0348	150,640
34	190991V	S 15TH ST	Gates	70	56			930	Paved	25	0.0287	52,080
35	190988M	DONNA REED RD	Underpass	0	0			2,620	Paved	30	0.0000	0

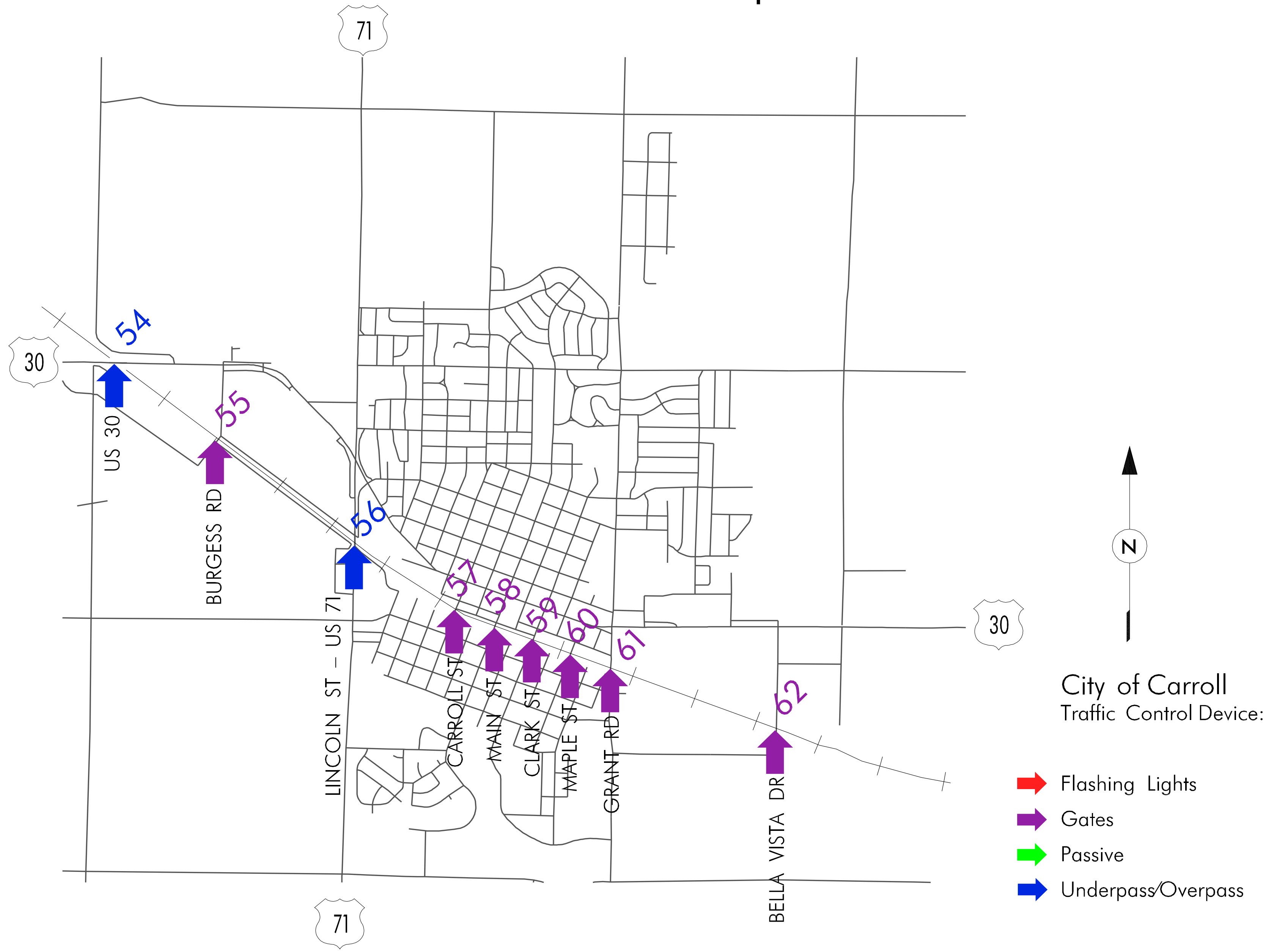
Carroll County Map



Carroll County Rail-Highway Crossings

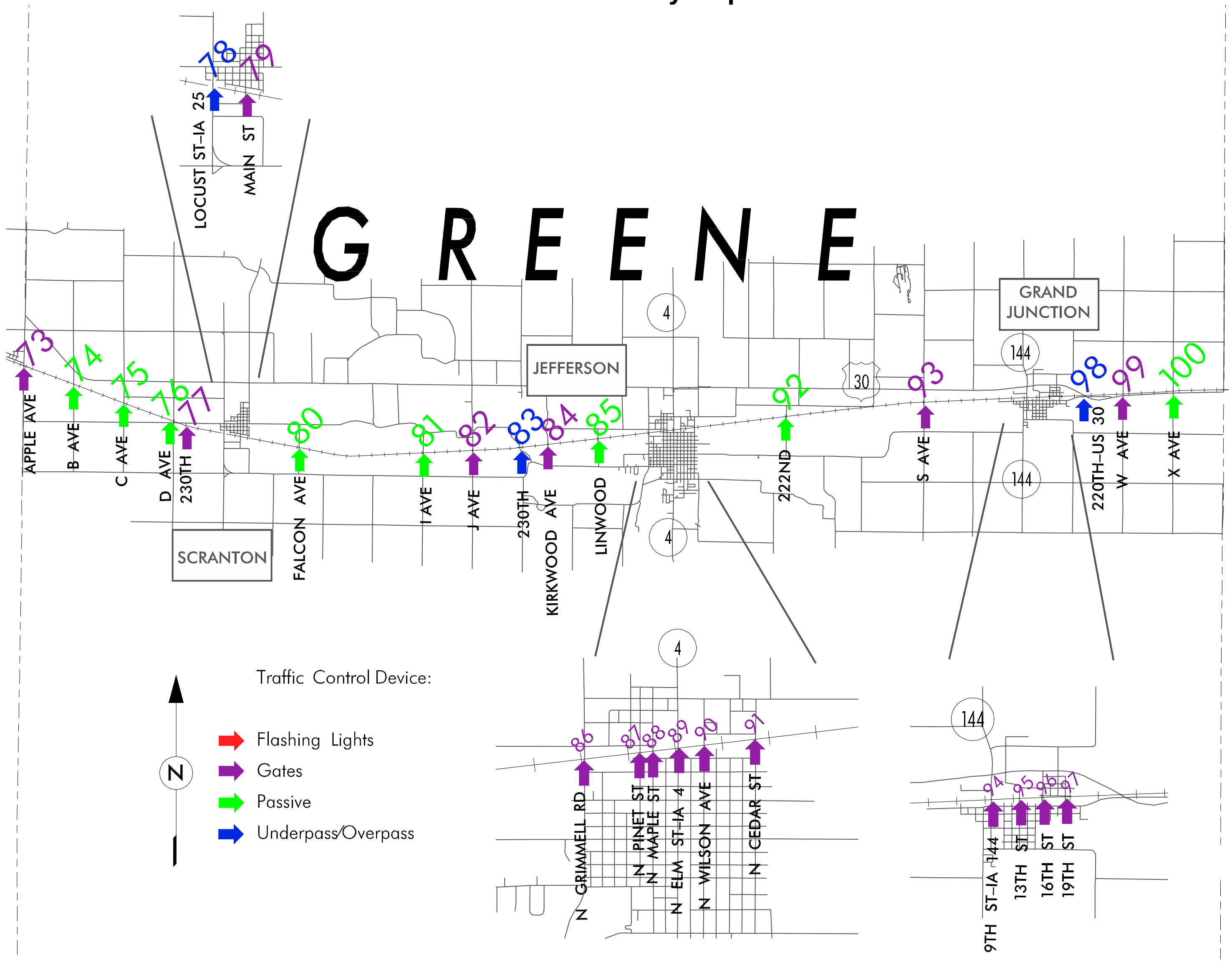
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
44	190790E	ASPEN AVE	Gates	70	56			520	Paved	55	0.0287	29,120
45	190789K	DIVISION ST-IA 285	Gates	70	56			1,570	Paved	55	0.0289	87,920
46	190787W	EAGLE AVE	Overpass	0	0			310	Paved	55	0.0000	0
47	190786P	FALCON AVE	Overpass	0	0			80	Gravel	55	0.0000	0
48	190785H	180TH ST	Overpass	0	0			30	Gravel	55	0.0000	0
49	190784B	GRANITE AVE	Gates	70	56			50	Gravel	55	0.0120	2,800
50	190783U	HAWTHORNE AVE	Gates	70	56			50	Gravel	55	0.0138	2,800
51	190782M	IVY AVE	Gates	70	56			410	Paved	55	0.0221	22,960
52	190780Y	JADE AVE	Passive	70	56			30	Gravel	55	0.0268	2,016
53	Unassigned Number											
63	190769Y	OLYMPIC AVE	Gates	70	56			970	Paved	55	0.0304	54,320
64	190768S	PHOENIX AVE	Gates	70	56			80	Gravel	55	0.0159	4,480
65	190767K	QUAIL AVE	Gates	70	56			120	Paved	55	0.0176	6,720
66	190766D	SYCAMORE AVE	Gates	70	56			70	Gravel	55	0.0170	3,920
67	190764P	IDAHO ST	Gates	70	56			92	Paved	25	0.0164	5,152
68	190763H	COLORADO ST	Gates	70	56	1		650	Paved	25	0.0644	36,400
69	190760M	VELVET AVE	Overpass	0	0			40	Gravel	55	0.0000	0
70	190759T	210TH ST	Gates	70	56	1		35	Gravel	55	0.0436	1,960
71	190757E	ZEPHYR AVE	Gates	70	56			90	Gravel	55	0.0156	5,040
72	190756X	1ST ST	Gates	70	56	1		60	Paved	35	0.0450	3,360

Carroll Urban Area Map



Carroll Urban Area Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
54	190779E	US 30	Underpass	0	0			7,900	Paved	55	0.0000	0
55	190778X	BURGESS RD	Gates	70	56			1,550	Paved	25	0.0321	86,800
56	190776J	LINCOLN ST-US71	Underpass	0	0			4,850	Paved	35	0.0000	0
57	190775C	CARROLL ST	Gates	55	56	1	2	2,390	Paved	25	0.0789	120,456
58	190774V	MAIN ST	Gates	55	56			5,600	Paved	20	0.0411	282,240
59	190773N	CLARK ST	Gates	55	56	1	1	4,470	Paved	25	0.0795	225,288
60	190772G	MAPLE ST	Gates	55	56			500	Paved	25	0.0248	25,200
61	190771A	GRANT RD	Gates	55	56			3,220	Paved	25	0.0372	162,288
62	911914P	BELLA VISTA DR	Gates	70	56			389	Paved	25	0.0236	21,784

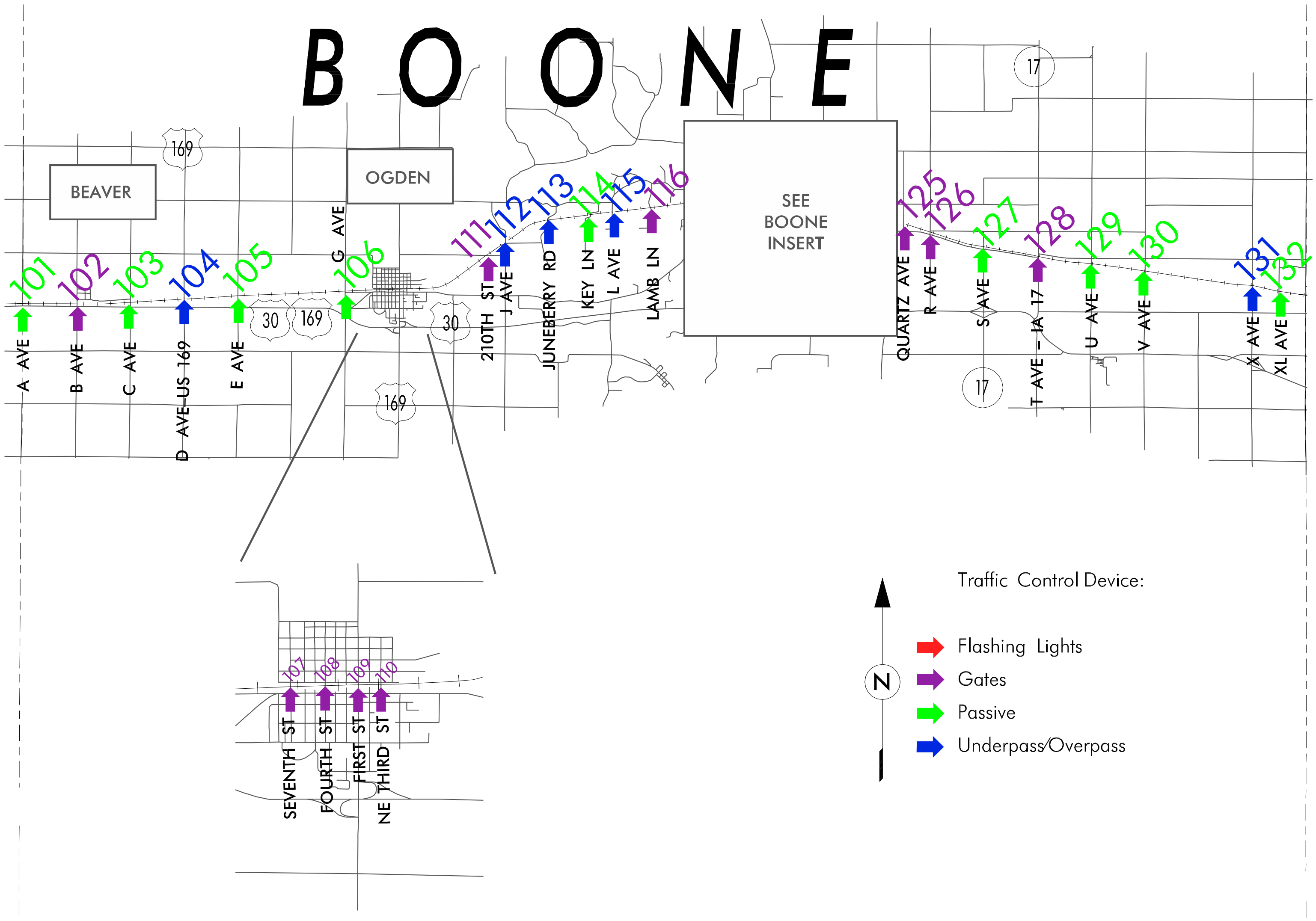
Greene County Map



Greene County Rail-Highway Crossings

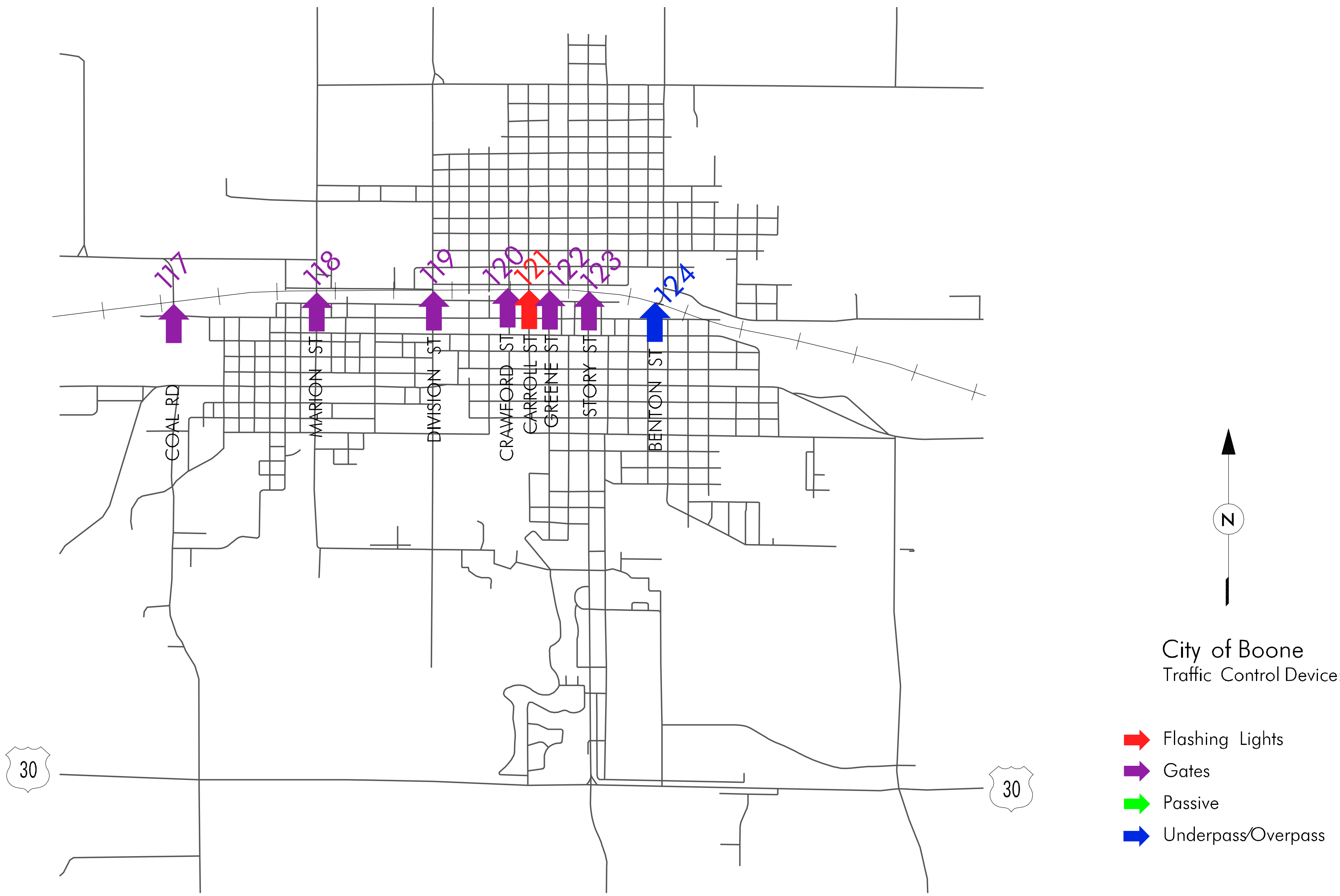
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
73	190753C	APPLE AVE	Gates	70	56			440	Paved	45	0.0210	14,000
74	190751N	B AVE	Passive	70	56			30	Gravel	55	0.0217	1,680
75	190750G	C AVE	Passive	70	56			15	Gravel	55	0.0175	840
76	190747Y	D AVE	Passive	70	56			20	Gravel	55	0.0188	1,120
77	190746S	230TH	Gates	70	56			80	Gravel	55	0.0159	8,960
78	190744D	LOCUST ST-IA 25	Underpass	0	0			1,130	Paved	45	0.0000	0
79	190743W	MAIN ST	Gates	70	56			960	Paved	25	0.0289	53,760
80	190742P	FALCON AVE	Passive	70	56	1		20	Gravel	55	0.0623	1,120
81	190738A	I AVE	Passive	70	56			35	Gravel	55	0.0225	1,960
82	190737T	J AVE	Gates	70	56			170	Paved	55	0.0184	9,520
83	190736L	230TH	Overpass	0	0			70	Gravel	55	0.0000	0
84	190735E	KIRKWOOD AVE	Gates	70	56			60	Gravel	55	0.0132	3,360
85	190734X	LINWOOD	Passive	70	56			10	Gravel	55	0.0153	560
86	190733R	N GRIMMELL RD	Gates	70	56			750	Paved	30	0.0253	42,000
87	190732J	N PINET ST	Gates	70	56			70	Gravel	25	0.0159	3,920
88	190731C	N MAPLE ST	Gates	70	56			651	Paved	25	0.0265	36,456
89	190730V	N ELM ST-IA 4	Gates	70	56			8,400	Paved	35	0.0520	470,400
90	190729B	N WILSON AVE	Gates	70	56			434	Paved	25	0.0241	24,304
91	190728U	N CEDAR ST	Gates	70	56	1	2	1,270	Paved	25	0.0295	71,120
92	190727M	222ND	Passive	70	56			35	Gravel	55	0.0225	1,960
93	190344K	S AVE	Gates	60	56			430	Paved	55	0.0253	24,080
94	190342W	9TH ST-IA 144	Gates	70	59			1,070	Paved	25	0.0302	61,525
95	190341P	13TH ST	Gates	70	59	1		200	Gravel	25	0.0541	11,500
96	190340H	16TH ST	Gates	70	59			1,440	Paved	25	0.0326	82,800
97	190339N	19TH ST	Gates	70	59			289	Paved	25	0.0221	16,618
98	190338G	220TH-US 30	Underpass	0	0			3,780	Paved	55	0.0000	0
99	190337A	W AVE	Gates	70	56			290	Paved	55	0.0213	16,240
100	190336T	X AVE	Passive	70	56	1		10	Gravel	55	0.0559	560

Boone County Map



Boone County Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
101	190335L	A AVE	Passive	70	56			25	Gravel	55	0.0205	1,400
102	190334E	B AVE	Gates	70	56			370	Paved	55	0.0208	20,720
103	190332R	C AVE	Passive	70	56	1		60	Gravel	55	0.0268	3,360
104	190331J	D AVE-US 169	Underpass	0	0			1,650	Paved	55	0.0000	0
105	190329H	E AVE	Passive	70	56	1		45	Gravel	55	0.0726	2,520
106	190326M	G AVE	Passive	70	56	1		30	Gravel	55	0.0676	1,680
107	190325F	SEVENTH ST	Gates	70	56			480	Paved	25	0.0245	26,880
108	190324Y	FOURTH ST	Gates	70	56			1,350	Paved	20	0.0310	75,600
109	190322K	FIRST ST	Gates	70	56			2,560	Paved	25	0.0356	143,360
110	190321D	NE THIRD ST	Gates	70	56			927	Paved	25	0.0287	51,912
111	190320W	210TH ST	Gates	70	56			40	Gravel	55	0.0120	4,480
112	190319C	J AVE	Underpass	0	0			40	Gravel	55	0.0000	0
113	190317N	JUNEBERRY RD	Overpass	0	0			40	Gravel	55	0.0000	0
114	190316G	KEY LN	Passive	70	56			35	Gravel	55	0.0225	2,352
115	190315A	L AVE	Underpass	0	0			25	Gravel	55	0.0000	0
116	190314T	LAMB LN	Gates	70	56	1		80	Gravel	55	0.0465	4,480
125	190723K	QUARTZ AVE	Gates	70	58			1,380	Paved	55	0.0317	80,040
126	190722D	R AVE	Gates	70	58			150	Gravel	55	0.0190	8,700
127	190721W	S AVE	Passive	70	58	4	1	10	Gravel	55	0.1779	580
128	190720P	T AVE-IA 17	Gates	70	62	3		2,480	Paved	55	0.1259	148,800
129	190718N	U AVE	Passive	70	58			50	Gravel	55	0.0257	2,900
130	190717G	V AVE	Passive	70	58			35	Gravel	55	0.0229	2,030
131	190716A	X AVE	Overpass	0	0			60	Gravel	55	0.0000	0
132	190715T	XL AVE	Passive	70	58	2		35	Gravel	55	0.1166	2,030

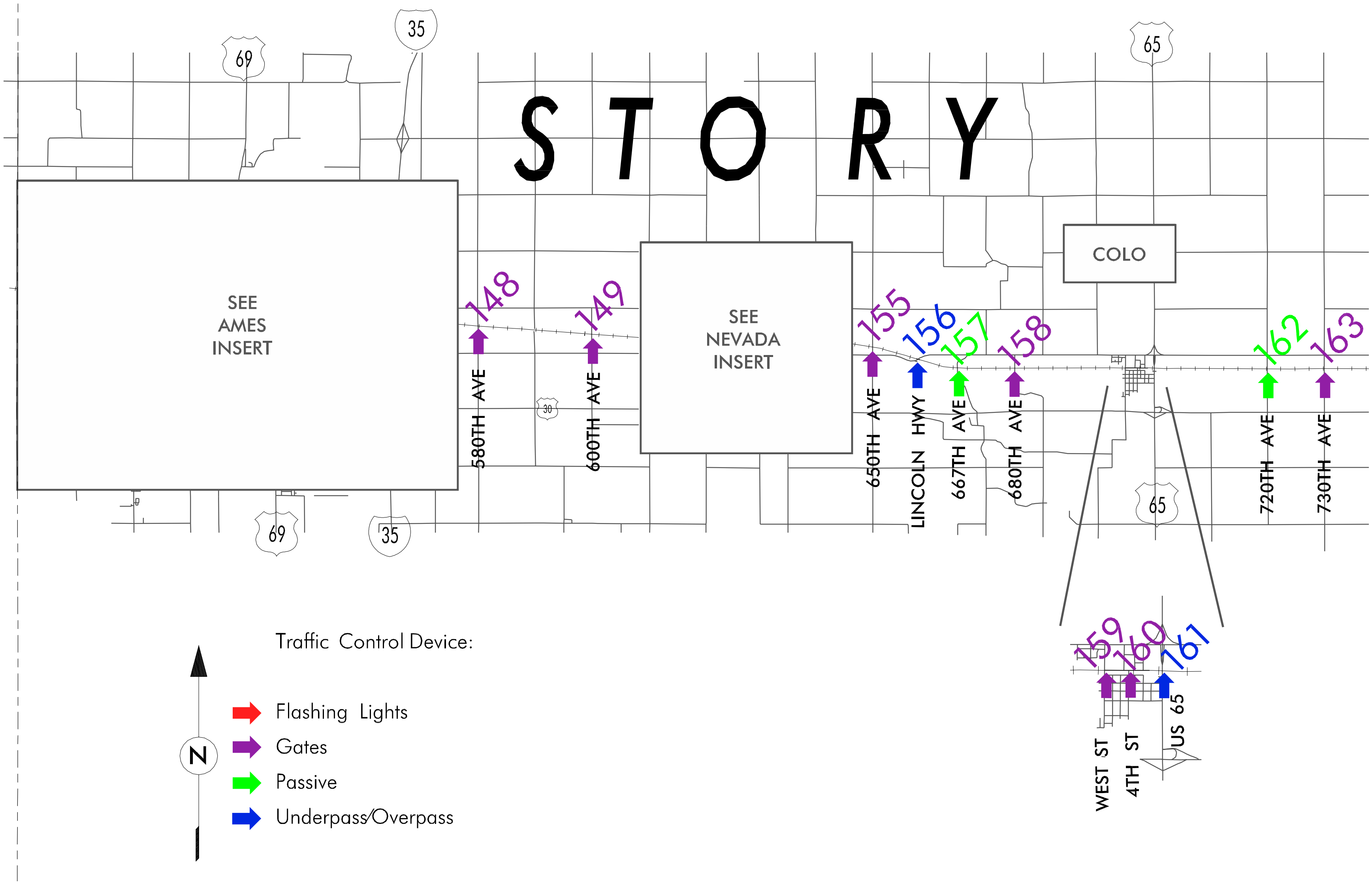
Boone Urban Area Map



Boone Urban Area Rail-Highway Crossings

Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
117	190311X	COAL RD	Gates	70	56	1		100	Gravel	25	0.0484	5,600
118	190309W	MARION ST	Gates	70	56			2,350	Paved	25	0.0348	131,600
119	190307H	DIVISION ST	Gates	45	56			2,510	Paved	25	0.0354	126,504
120	190305U	CRAWFORD ST	Gates	45	58			550	Paved	25	0.0258	28,215
121	190302Y	CARROLL ST	Flashing Lights	45	37			640	Paved	25	0.0410	20,736
122	190301S	GREENE ST	Gates	45	61	1		2,750	Paved	25	0.0366	144,788
123	190300K	STORY ST	Gates	45	58	1		4,310	Paved	20	0.0866	221,103
124	190724S	BENTON ST	Overpass	0	0			6,000	Paved	25	0.0000	0

Story County Map



Story County Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
148	190698E	580TH AVE	Gates	70	66			430	Paved	55	0.0251	26,660
149	190697X	600TH AVE	Gates	70	58			130	Gravel	55	0.0184	7,540
155	190690A	650TH AVE	Gates	70	58			730	Paved	55	0.0274	42,340
156	190689F	LINCOLN HWY	Overpass	0	0			1,650	Paved	55	0.0000	0
157	190688Y	667TH AVE	Passive	70	58	1	1	60	Gravel	55	0.0774	3,480
158	190687S	680TH AVE	Gates	70	58			50	Gravel	55	0.0144	2,900
159	190686K	WEST ST	Gates	70	58			1,000	Paved	25	0.0295	59,740
160	190685D	4TH ST	Gates	70	58			550	Paved	25	0.0257	31,900
161	190684W	US 65	Overpass	0	0			2,010	Paved	55	0.0000	0
162	190682H	720TH AVE	Passive	70	58			10	Dirt	55	0.0153	580
163	190681B	730TH AVE	Gates	70	58	4		80	Gravel	55	0.1398	4,640

Ames Urban Area Map

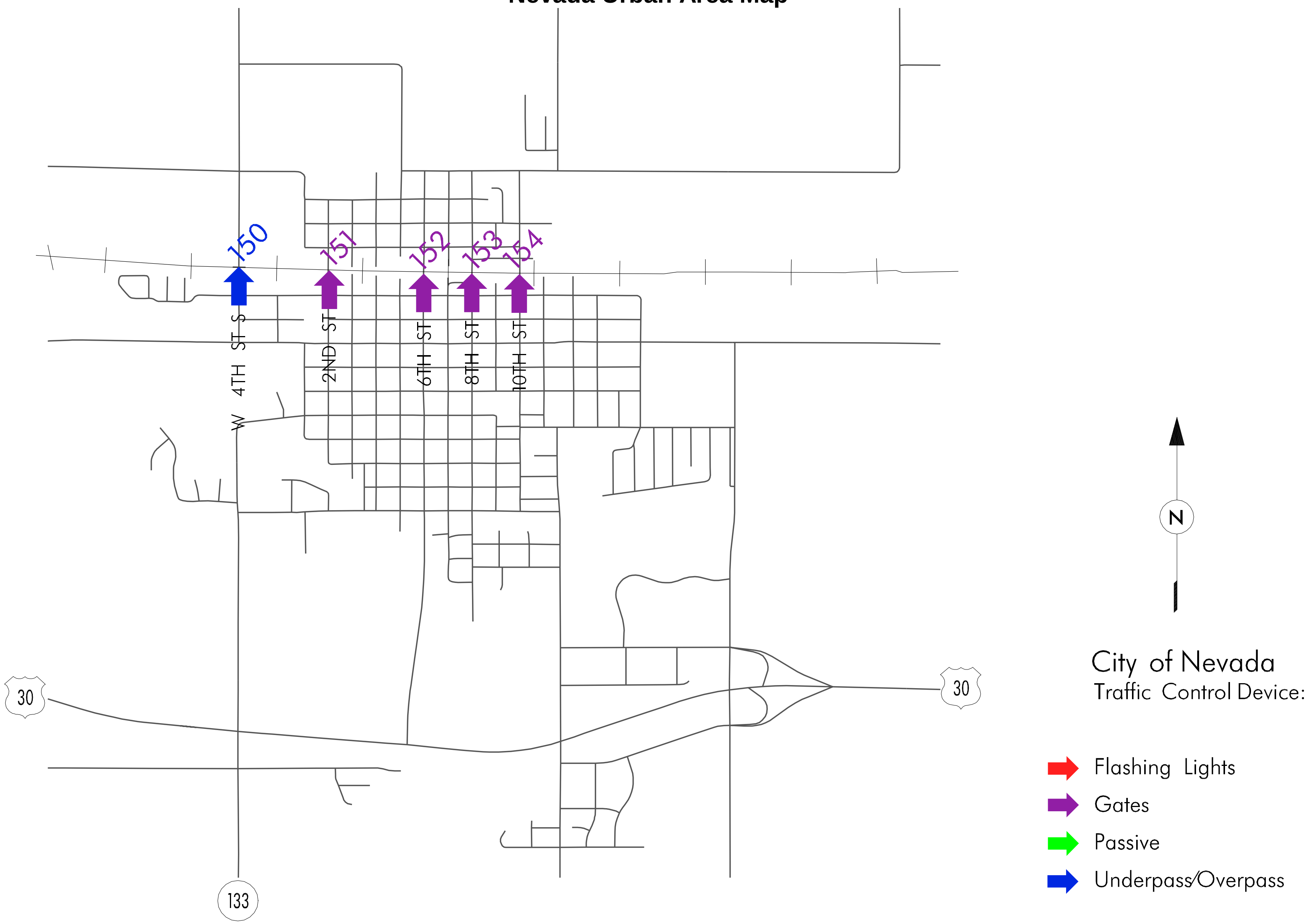
Ames Urban Area Rail-Highway Crossings

Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
133	190714L	500TH AVE	Overpass	0	0			1,890	Paved	55	0.0000	0
134	190712X	N DAKOTA AVE	Gates	70	58			900	Paved	35	0.0287	52,200
135	190711R	ISU	Gates	60	62			70	Paved	25	0.0138	4,200
136	190710J	MINNESOTA AVE	Underpass	0	0			607	Gravel	25	0.0000	0
137	199643X	13TH ST	Overpass	0	0			13,200	Paved	35	0.0000	0
138	190709P	STANGE RD*	Overpass	0	0			0	Paved	25	0.0000	0
139	190708H	HABER RD*	Overpass	0	0			0	Paved	35	0.0000	0
140	190707B	6TH ST	Overpass	0	0			8,600	Paved	30	0.0000	0
141	190706U	HAZEL AVE	Gates	60	66			2,240	Paved	25	0.0430	138,880
142	190705M	GRAND AVE-US 69	Overpass	0	0			14,600	Paved	35	0.0000	0
143	190704F	CLARK AVE	Gates	40	66			6,900	Paved	25	0.0522	385,020
144	190703Y	KELLOGG AVE	Gates	40	66			5,200	Paved	20	0.0498	290,160
145	190702S	DUFF AVE	Gates	40	66	3	1	14,500	Paved	25	0.1184	809,100
146	190700D	DAYTON AVE**	Gates	70	66			7,900	Paved	45	0.0455	489,800
147	190699L	I-35	Underpass	0	0			21,000	Paved	65	0.0000	0

*Park and Institutional Road—AADT is not collected.

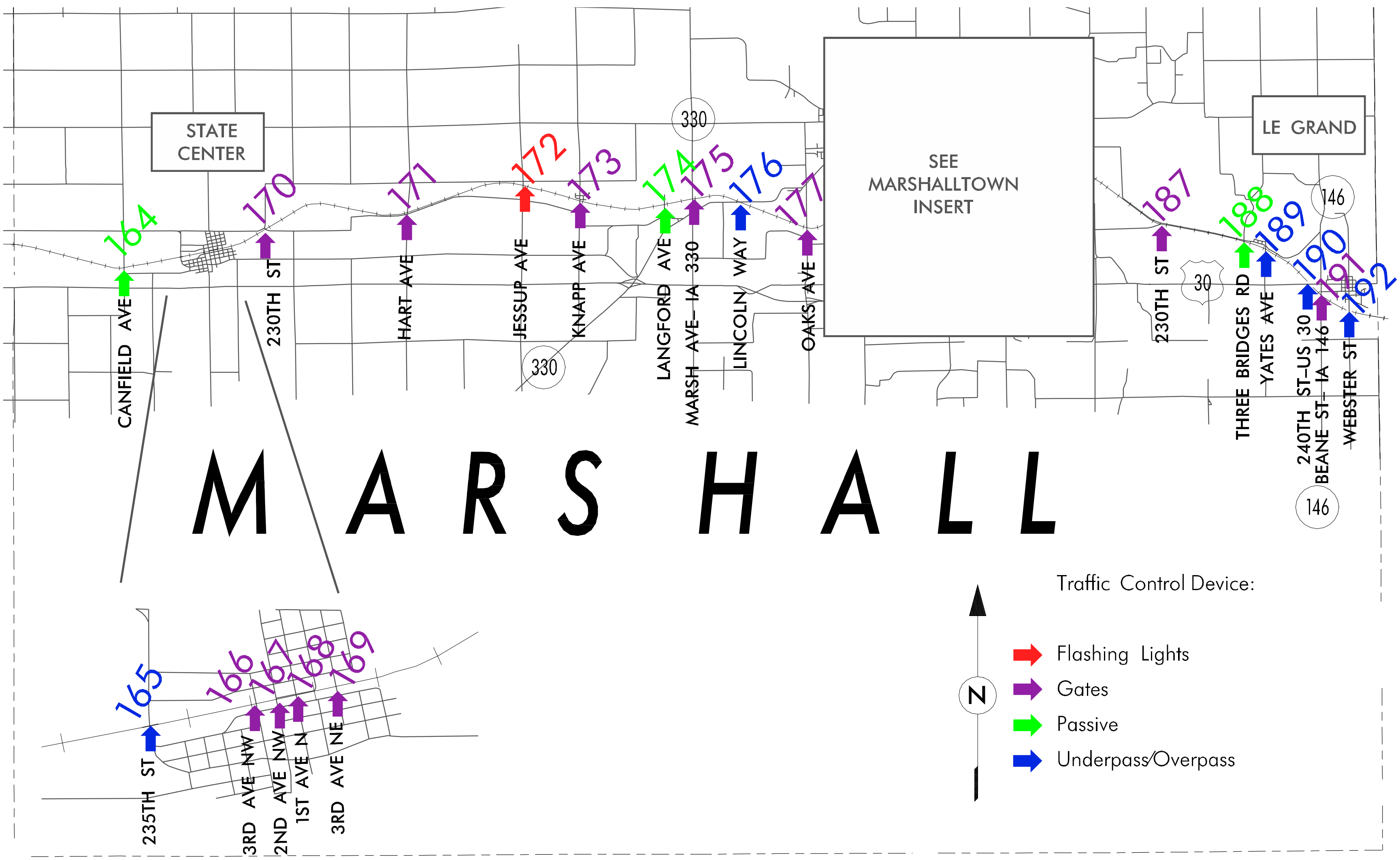
**Roadway is being reconstructed from a two-lane to a three-lane facility with the capability of being widened to five lanes as traffic counts increase; a bridge is being constructed over the UP tracks. Completion is scheduled for late December 2002.

Nevada Urban Area Map



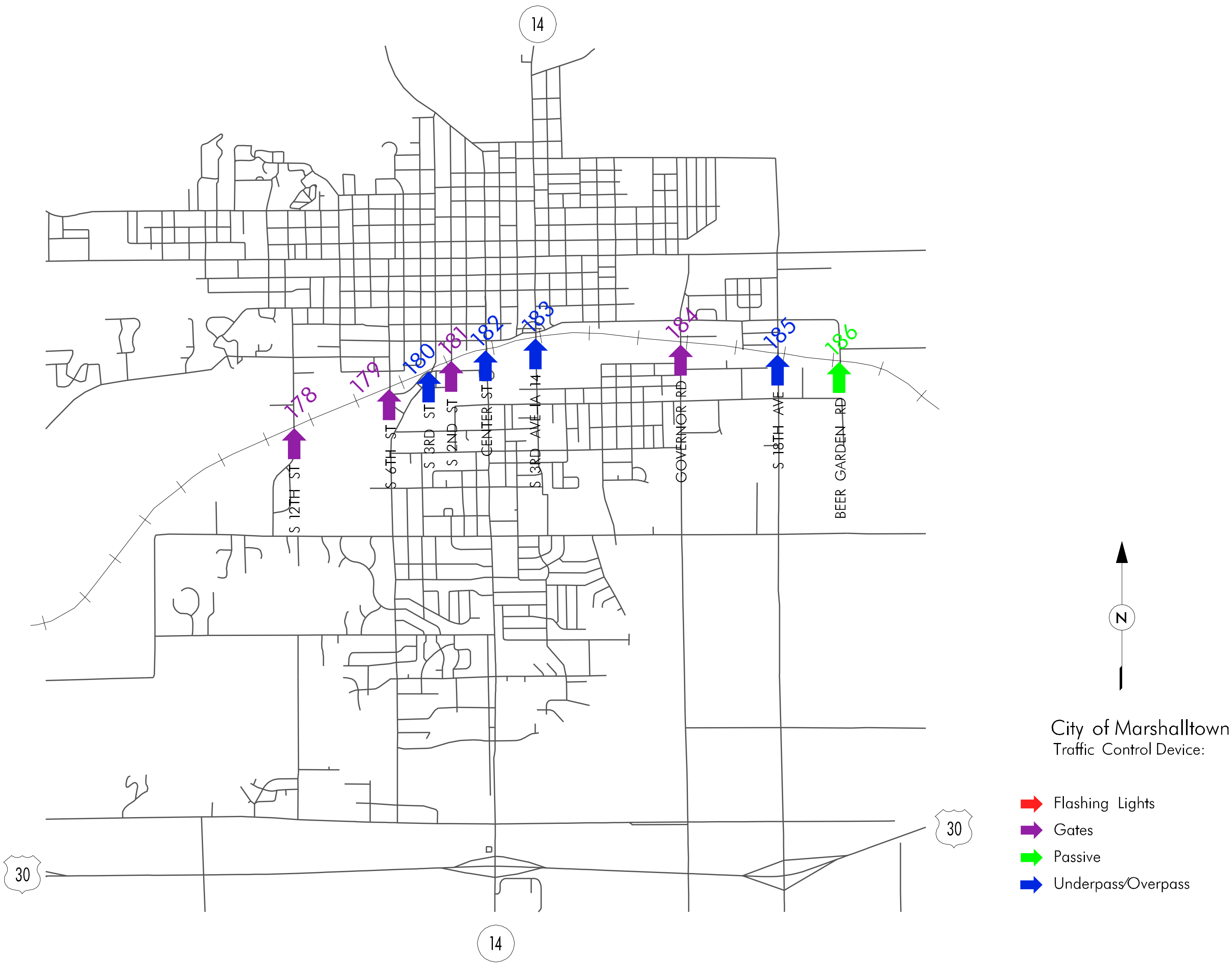
Nevada Urban Area Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
150	190696R	W 4TH ST S	Overpass	0	0			1,260	Paved	55	0.0000	0
151	190695J	2ND ST	Gates	70	58			680	Paved	25	0.0271	39,440
152	190694C	6TH ST	Gates	70	58			1,360	Paved	20	0.0308	78,880
153	190693V	8TH ST	Gates	70	58	1	1	8,500	Paved	25	0.0679	49,300
154	190692N	10TH ST	Gates	70	58			1,790	Paved	25	0.0333	103,820

Marshall County Map



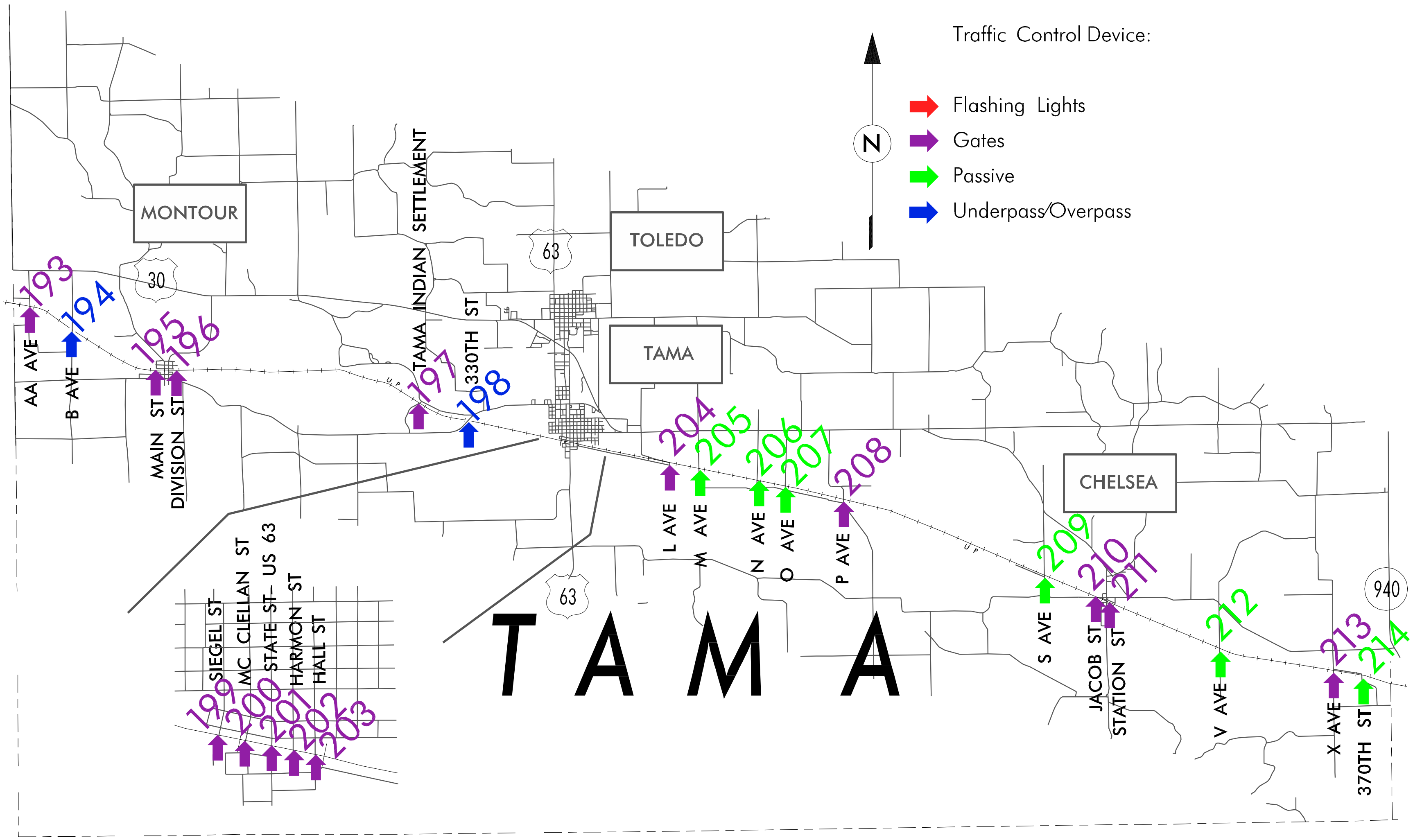
Marshall County Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
164	190676E	CANFIELD AVE	Passive	70	58	1		10	Dirt	55	0.0559	580
165	190675X	235TH ST	Overpass	0	0			580	Paved	55	0.0000	0
166	190674R	3RD AVE NW	Gates	70	58			1,020	Paved	25	0.0295	59,160
167	190673J	2ND AVE NW	Gates	70	58			330	Paved	25	0.0228	19,140
168	190672C	1ST AVE N	Gates	70	58	2		1,870	Paved	20	0.1155	108,460
169	190671V	3RD AVE NE	Gates	70	58			460	Paved	25	0.0248	26,680
170	190670N	230TH ST	Gates	70	58			25	Gravel	55	0.0119	1,450
171	190669U	HART AVE	Gates	70	58			110	Gravel	55	0.0167	6,380
172	190665S	JESSUP AVE	Flashing Lights	70	58			35	Gravel	55	0.0197	2,030
173	190664K	KNAPP AVE	Gates	70	58			300	Paved	35	0.0223	17,400
174	190663D	LANGFORD AVE	Passive	70	58			10	Gravel	55	0.0153	580
175	190662W	MARSH AVE-IA 330	Gates	70	58	1		2,600	Paved	55	0.0361	150,800
176	190660H	LINCOLN WAY	Underpass	0	0			2,800	Paved	55	0.0000	0
177	190658G	OAKS AVE	Gates	70	58			100	Gravel	55	0.0173	5,800
187	190618J	230TH ST	Gates	70	60	1		70	Gravel	55	0.0465	4,956
188	190616V	THREE BRIDGES RD	Passive	70	58			10	Gravel	55	0.0153	580
189	190615N	YATES AVE	Underpass	0	0			120	Paved	55	0.0000	0
190	190614G	240TH ST-US 30	Underpass	0	0			10,200	Paved	45	0.0000	0
191	190613A	BEANE ST-IA 146	Gates	70	58			2,230	Paved	35	0.0351	129,340
192	190612T	WEBSTER ST	Underpass	0	0			780	Paved	25	0.0000	0

Marshalltown Urban Area Map



Marshalltown Urban Area Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
178	190626B	S 12TH ST	Gates	60	58			1,860	Paved	35	0.0359	107,880
179	190625U	S 6TH ST	Gates	60	58			4,660	Paved	25	0.0444	270,280
180	190624M	S 3RD ST	Underpass	0	0			9,900	Paved	35	0.0000	0
181	190623F	S 2ND ST	Gates	60	88	2		700	Paved	30	0.0701	51,100
182	190622Y	CENTER ST	Underpass	0	0			12,700	Paved	25	0.0000	0
183	190621S	S 3RD AVE-IA 14	Underpass	0	0			12,100	Paved	35	0.0000	0
184	190620K	GOVERNOR RD	Gates	60	98	1		4,060	Paved	30	0.0847	316,680
185	200129E	S 18TH AVE	Underpass	0	0			8,500	Paved	35	0.0000	0
186	190619R	BEER GARDEN RD	Passive	60	58			100	Gravel	35	0.0299	5,800

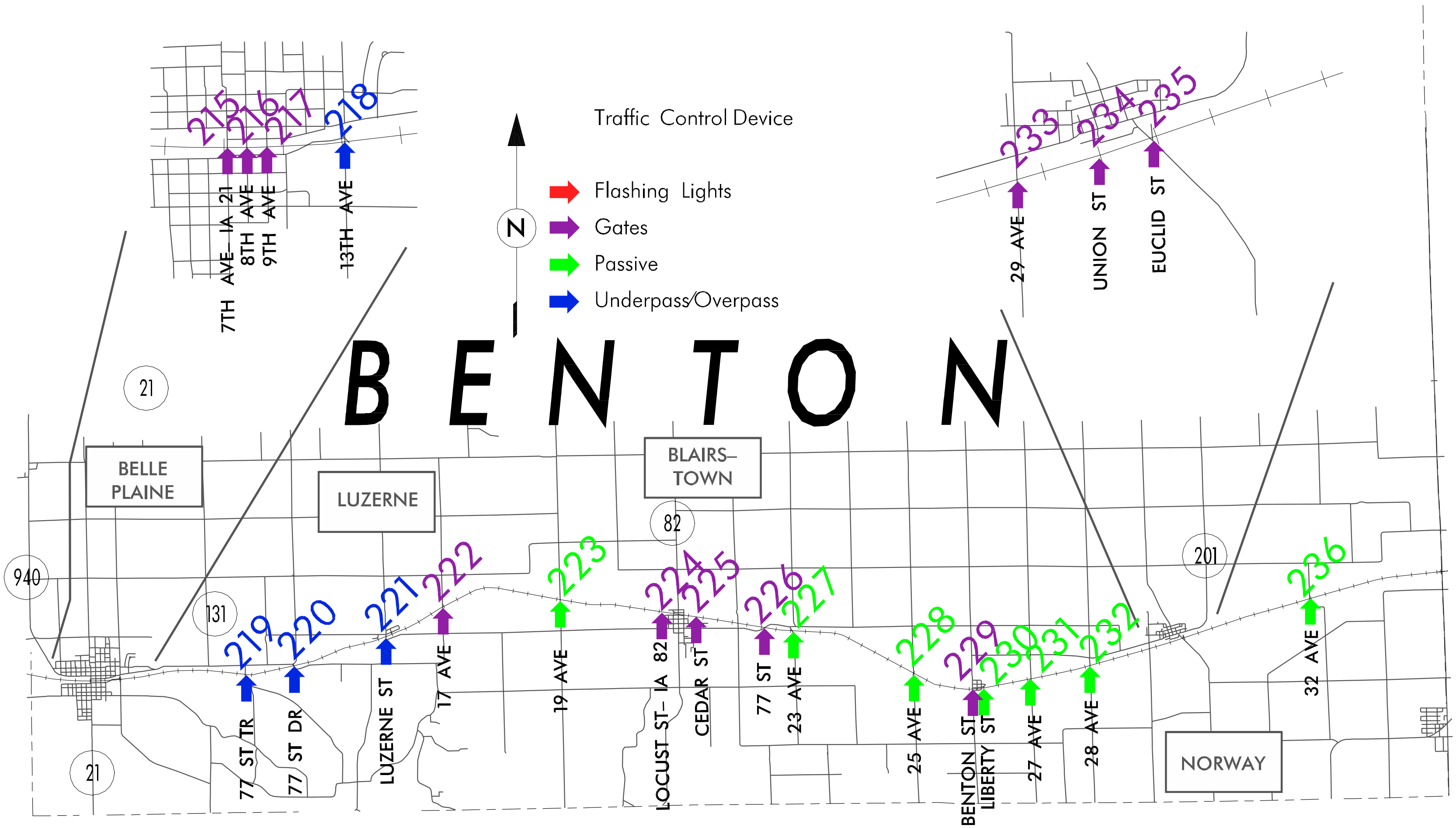
Tama County Map



Tama County Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001		AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
						Colli-sions	Collision Deaths					
193	190611L	AA AVE	Gates	70	58			70	Gravel	55	0.0132	4,060
194	192032J	B AVE	Underpass	0	0			25	Gravel	55	0.0000	0
195	190610E	MAIN ST	Gates	60	58			810	Paved	25	0.0278	46,980
196	190609K	DIVISION ST	Gates	60	58			380	Paved	25	0.0236	22,040
197	190607W	TAMA INDIAN SETTLEMENT*	Gates	70	58	1		0	Gravel	30	0.0214	0
198	190606P	330TH ST	Underpass	0	0			1,170	Paved	55	0.0000	0
199	190604B	SIEGEL ST	Gates	60	58			490	Paved	25	0.0251	28,420
200	190603U	MC CLELLAN ST	Gates	60	58			150	Paved	20	0.0190	8,700
201	190602M	STATE ST-US 63	Gates	60	58			4,090	Paved	35	0.0398	237,220
202	190601F	HARMON ST	Gates	60	58			871	Paved	20	0.0284	50,518
203	190600Y	HALL ST	Gates	60	58			434	Gravel	25	0.0243	25,172
204	190599G	L AVE	Gates	60	58			70	Gravel	55	0.0138	4,060
205	190598A	M AVE	Passive	60	58			10	Gravel	55	0.0143	580
206	190597T	N AVE	Passive	60	58			25	Gravel	55	0.0192	1,450
207	190596L	O AVE	Passive	60	58			30	Dirt	55	0.0166	1,740
208	190593R	P AVE	Gates	70	60			50	Gravel	55	0.0144	2,950
209	190592J	S AVE	Passive	60	58	1		5	Dirt	55	0.0115	290
210	190591C	JACOB ST	Gates	60	58			190	Paved	20	0.0200	22,040
211	190590V	STATION ST	Gates	60	58			367	Paved	20	0.0236	21,286
212	190587M	V AVE	Passive	60	58			15	Gravel	55	0.0166	870
213	190584S	X AVE	Gates	70	60			25	Gravel	55	0.0123	1,475
214	190583K	370TH ST	Passive	60	58			10	Gravel	55	0.0143	580

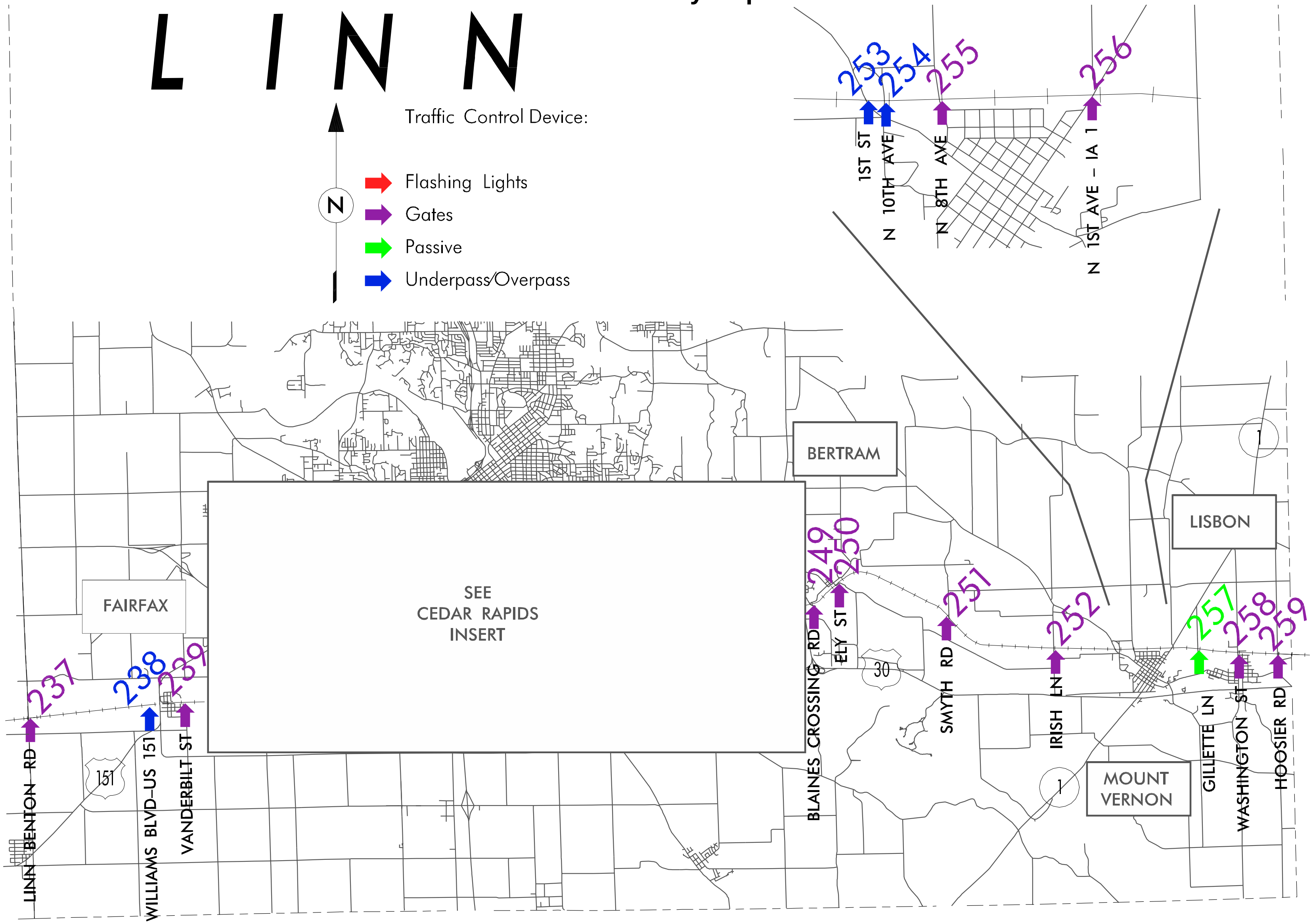
*Park and Institutional Road—AADT is not collected.

Benton County Map



Benton County Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001		AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
						Colli-sions	Collision Deaths					
215	190581W	7TH AVE-IA 21	Gates	60	58	1	1	5,100	Paved	30	0.1026	295,800
216	190580P	8TH AVE	Gates	60	58	1		1,390	Paved	15	0.0732	80,620
217	190579V	9TH AVE	Gates	60	58			1,175	Paved	15	0.0304	68,150
218	190578N	13TH AVE	Overpass	0	0			1,100	Paved	25	0.0000	0
219	190577G	77 ST TR	Overpass	0	0			170	Gravel	55	0.0000	0
220	190576A	77 ST DR	Overpass	0	0			1,060	Paved	55	0.0000	0
221	190574L	LUZERNE ST	Underpass	0	0			340	Paved	25	0.0000	0
222	190572X	17 AVE	Gates	60	58			50	Gravel	55	0.0144	2,900
223	190571R	19 AVE	Passive	60	58			30	Gravel	55	0.0279	1,740
224	190569P	LOCUST ST-IA 82	Gates	60	59			2,300	Paved	20	0.0355	134,550
225	190568H	CEDAR ST	Gates	70	58			981	Paved	25	0.0293	56,898
226	190565M	77 ST	Gates	60	58			810	Paved	55	0.0298	56,376
227	190564F	23 AVE	Passive	60	58	2		60	Gravel	55	0.0257	3,480
228	190563Y	25 AVE	Passive	60	58			15	Dirt	55	0.0166	870
229	190562S	BENTON ST	Gates	60	58			340	Paved	35	0.0218	19,720
230	190560D	LIBERTY ST	Passive	60	58	1		150	Gravel	25	0.0845	8,700
231	190558C	27 AVE	Passive	60	58			15	Dirt	55	0.0166	870
232	190556N	28 AVE	Passive	60	58			10	Dirt	55	0.0115	580
233	190553T	29 AVE	Gates	60	58			220	Gravel	55	0.0195	12,760
234	190552L	UNION ST	Gates	60	58			981	Paved	25	0.0293	56,898
235	190551E	EUCLID ST	Gates	60	58			2,280	Paved	25	0.0350	132,240
236	190547P	32 AVE	Passive	60	58			10	Dirt	55	0.0143	580

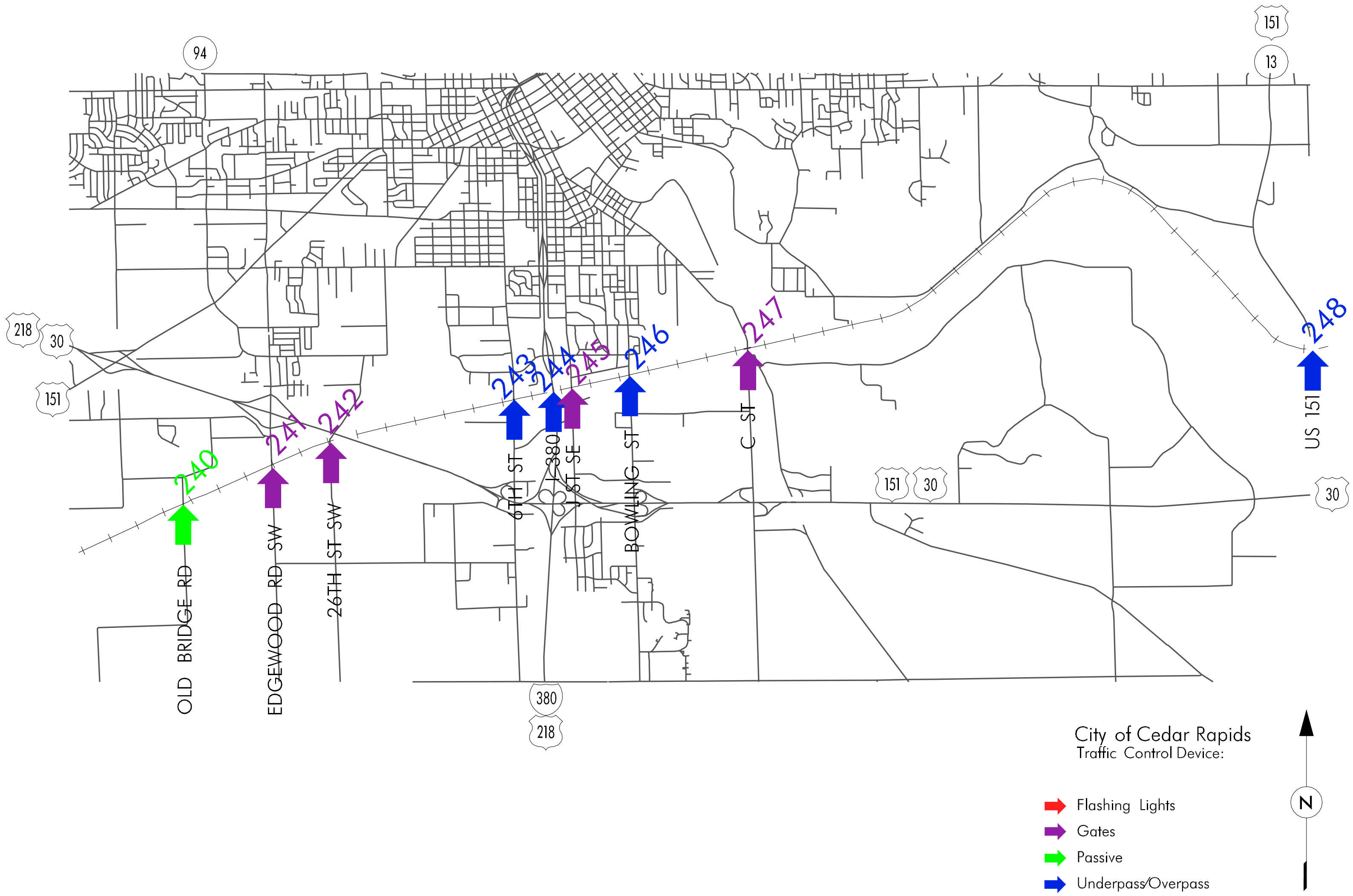
Linn County Map



Linn County Rail-Highway Crossings

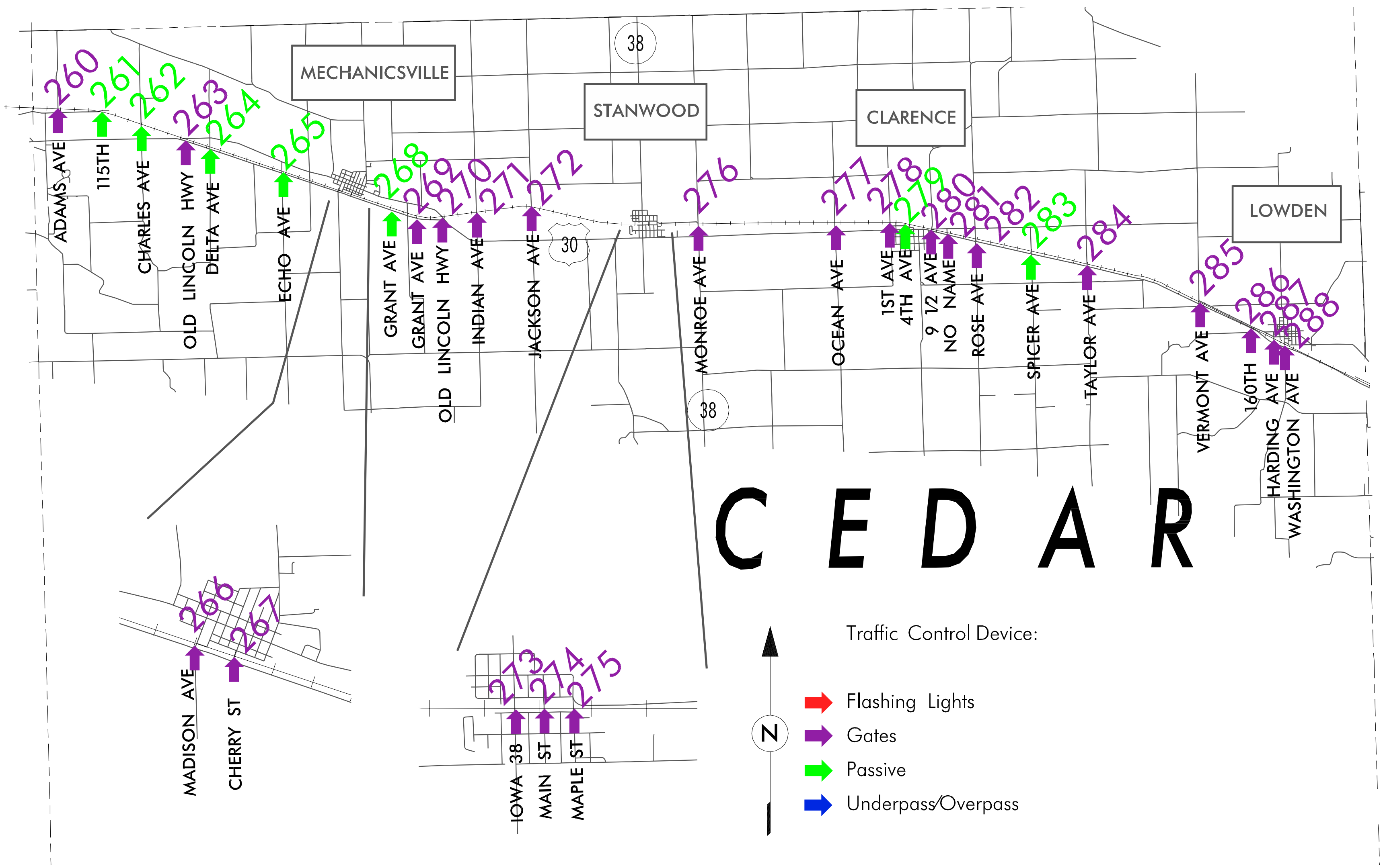
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
237	190543M	LINN BENTON RD	Gates	70	58			90	Gravel	55	0.0167	5,220
238	190539X	WILLIAMS BLVD-US 151	Underpass	0	0			8,900	Paved	45	0.0000	0
239	190538R	VANDERBILT ST	Gates	60	58			1,190	Paved	20	0.0306	69,020
249	190478J	BLAINES CROSSING RD	Gates	60	58			152	Paved	25	0.0189	8,816
250	190477C	ELY ST	Gates	60	58			80	Paved	25	0.0187	8,120
251	190476V	SMYTH RD	Gates	70	58			80	Gravel	55	0.0135	5,568
252	190475N	IRISH LN	Gates	70	59			120	Gravel	55	0.0167	5,265
253	190474G	1ST ST	Underpass	0	0			2,540	Paved	25	0.0000	0
254	190473A	N 10TH AVE	Underpass	0	0			434	Paved	25	0.0000	0
255	190472T	N 8TH AVE	Gates	70	58	1		510	Paved	25	0.0625	29,580
256	190471L	N 1ST AVE-IA 1	Gates	70	58	1		3,710	Paved	35	0.0855	215,180
257	190469K	GILLETTE LN	Passive	70	58			152	Gravel	35	0.0355	8,816
258	190468D	WASHINGTON ST	Gates	70	58			800	Paved	25	0.0281	46,400
259	190465H	HOOSIER RD	Gates	70	58			70	Gravel	55	0.0176	6,380

Cedar Rapids Urban Area Map



Cedar Rapids Urban Area Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
240	190533G	OLD BRIDGE RD	Passive	70	256	1	1	50	Gravel	55	0.0833	3,140
241	190532A	EDGEWOOD RD SW	Gates	70	158			2,400	Paved	45	0.0429	259,200
242	190526W	26TH ST SW	Gates	70	58			260	Gravel	35	0.0216	18,096
243	190530L	6TH ST	Underpass	0	0			13,200	Paved	45	0.0000	0
244	200120T	I-380	Underpass	0	0			57,500	Paved	60	0.0000	0
245	190529S	J ST SE	Gates	70	58	1	1	6,879	Paved	35	0.0930	398,982
246	190528K	BOWLING ST	Underpass	0	0			7,100	Paved	35	0.0000	0
247	190527D	C ST	Gates	70	58			2,300	Paved	35	0.0314	106,720
248	190479R	US 151	Underpass	0	0			8,900	Paved	65	0.0000	0

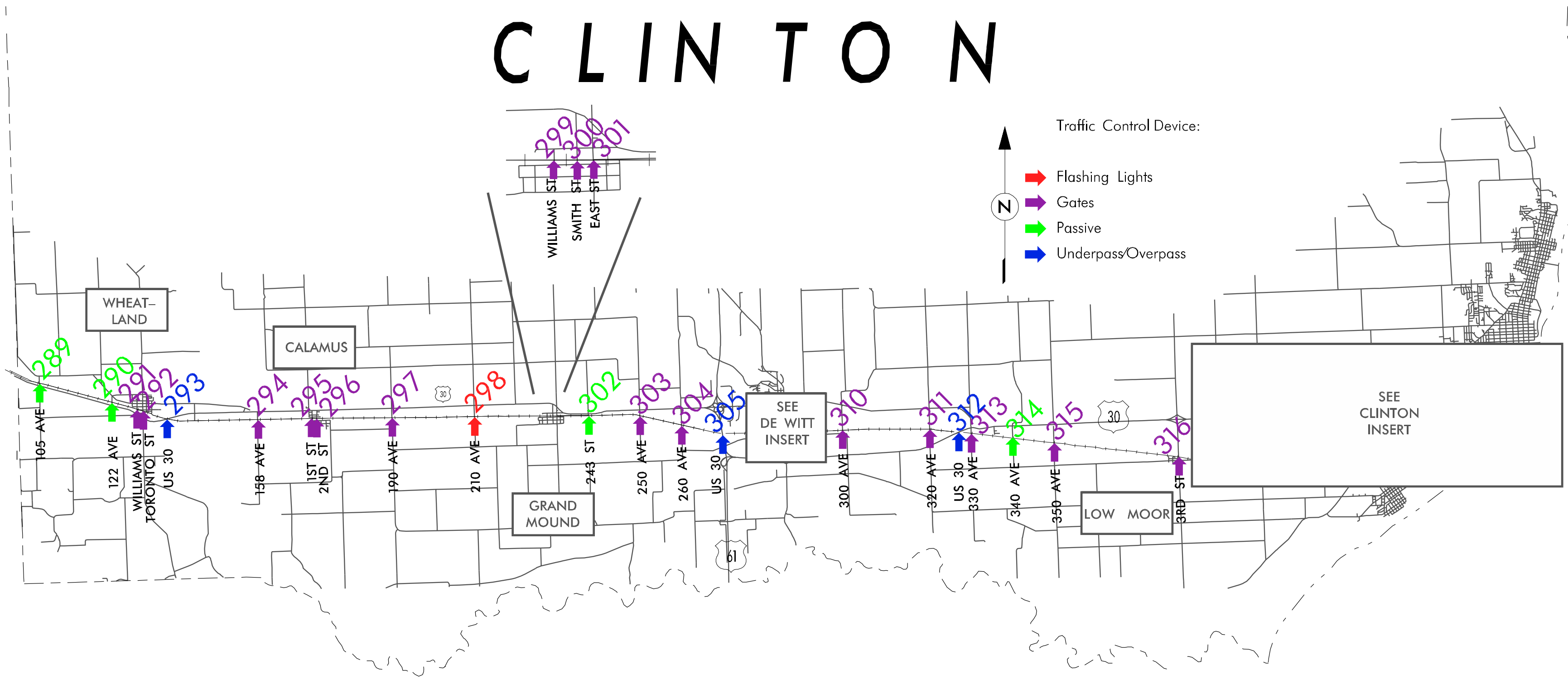
Cedar County Map



Cedar County Rail-Highway Crossings

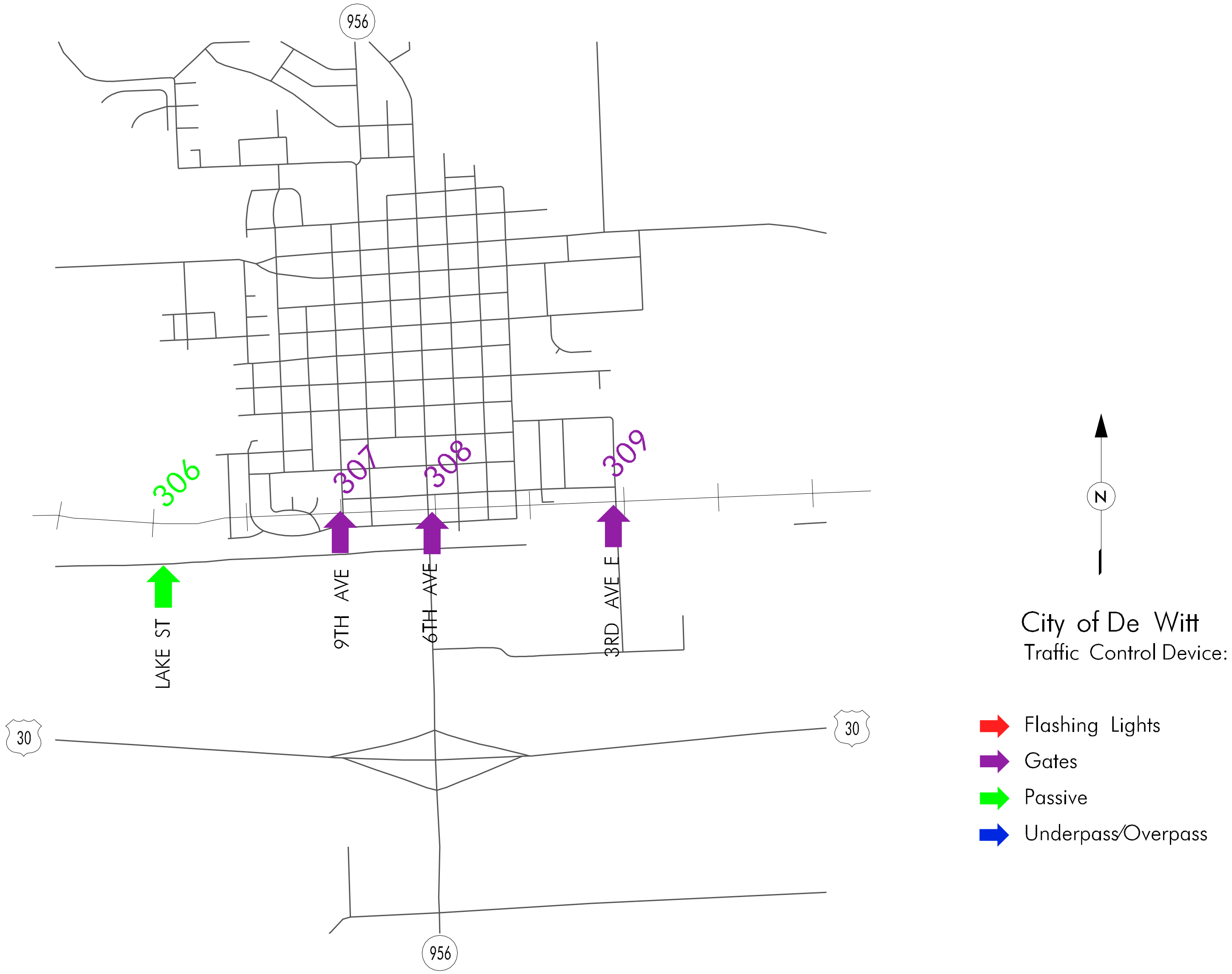
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
260	190463U	ADAMS AVE	Gates	70	58			40	Gravel	55	0.0135	2,320
261	190461F	115TH	Passive	70	58			10	Gravel	55	0.0153	696
262	190460Y	CHARLES AVE	Passive	70	58			15	Gravel	55	0.0175	870
263	190458X	OLD LINCOLN HWY	Gates	70	58			70	Gravel	55	0.0156	8,120
264	190457R	DELTA AVE	Passive	70	58	1		60	Gravel	55	0.0774	3,480
265	190455C	ECHO AVE	Passive	70	58			25	Gravel	55	0.0209	1,450
266	190453N	MADISON ST	Gates	70	58			1,770	Paved	25	0.0333	102,660
267	190452G	CHERRY ST	Gates	70	58	1		2,030	Paved	25	0.0343	117,740
268	190454V	GRANT AVE	Passive	70	58			25	Gravel	55	0.0209	1,450
269	190451A	GRANT AVE	Gates	70	58			80	Gravel	55	0.0161	4,640
270	190450T	OLD LINCOLN HWY	Gates	70	58			70	Gravel	55	0.0156	4,872
271	190449Y	INDIAN AVE	Gates	70	58	1		40	Gravel	55	0.0425	2,320
272	190447K	JACKSON AVE	Gates	70	58			90	Gravel	55	0.0167	5,220
273	190445W	IOWA 38	Gates	70	58			1,820	Paved	25	0.0339	105,560
274	190443H	MAIN ST	Gates	70	58			370	Paved	25	0.0236	21,460
275	190442B	MAPLE ST	Gates	70	58			490	Paved	25	0.0251	28,420
276	190440M	MONROE AVE	Gates	70	58			120	Gravel	55	0.0178	6,960
277	190437E	OCEAN AVE	Gates	70	58			100	Gravel	55	0.0173	5,800
278	190436X	1ST AVE	Gates	70	58			270	Paved	25	0.0195	15,660
279	190435R	4TH AVE	Passive	70	58			152	Paved	25	0.0539	8,816
280	190430G	9 1/2 AVE	Gates	70	58			860	Paved	25	0.0285	49,880
281	190429M	NO NAME	Gates	70	58			5	Gravel	55	0.0077	290
282	190428F	ROSE AVE	Gates	70	58			120	Gravel	55	0.0178	6,960
283	190425K	SPICER AVE	Passive	70	58			20	Dirt	55	0.0192	1,160
284	190424D	TAYLOR AVE	Gates	70	58			80	Gravel	55	0.0161	4,640
285	190420B	VERMONT AVE	Gates	70	58			80	Paved	55	0.0161	4,640
286	190419G	160TH	Gates	70	58			390	Paved	55	0.0238	22,620
287	190417T	HARDING AVE	Gates	70	58			110	Paved	25	0.0176	6,380
288	190414X	WASHINGTON AVE	Gates	70	58			2,010	Paved	25	0.0343	116,580

Clinton County Map



Clinton County Rail-Highway Crossings												
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001 Colli-sions	1996-2001 Collision Deaths	AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
289	190408U	105 AVE	Passive	70	58			20	Gravel	55	0.0192	1,160
290	190409B	122 AVE	Passive	70	58			35	Gravel	55	0.0229	2,030
291	190407M	WILLIAMS ST	Gates	70	58			289	Paved	25	0.0221	16,762
292	190406F	TORONTO ST	Gates	70	58			1,590	Paved	25	0.0324	92,220
293	190405Y	US 30	Underpass	0	0			3,220	Paved	55	0.0000	0
294	190403K	158 AVE	Gates	70	58			140	Gravel	55	0.0187	8,120
295	190401W	1ST ST	Gates	70	58			289	Paved	25	0.0221	16,762
296	190400P	2ND ST	Gates	70	58			2,210	Paved	25	0.0348	128,180
297	190399X	190 AVE	Gates	70	58			560	Paved	55	0.0260	32,480
298	190398R	210 AVE	Flashing Lights	70	58	2	1	40	Gravel	55	0.0870	2,320
299	190397J	WILLIAMS ST	Gates	70	58			289	Paved	25	0.0221	16,762
300	190396C	SMITH ST	Gates	70	58			510	Paved	25	0.0253	29,580
301	190395V	EAST ST	Gates	70	58			1,890	Paved	35	0.0336	109,620
302	190394N	243 ST	Passive	70	58			60	Gravel	55	0.0272	3,480
303	190391T	250 AVE	Gates	70	58			40	Gravel	55	0.0135	2,320
304	190390L	260 AVE	Gates	70	58			780	Paved	35	0.0278	45,240
305	200119Y	US 30	Underpass	0	0			10,700	Paved	65	0.0000	0
310	190385P	300 AVE	Gates	70	58			190	Gravel	55	0.0200	11,020
311	190384H	320 AVE	Gates	70	58			50	Gravel	55	0.0144	2,900
312	200118S	US 30	Underpass	0	0			7,500	Paved	65	0.0000	0
313	190383B	330 AVE	Gates	70	58			90	Paved	55	0.0167	5,220
314	190380F	340 AVE	Passive	70	58			15	Gravel	55	0.0175	870
315	190379L	350 AVE	Gates	70	58			110	Gravel	55	0.0176	6,380
316	190377X	3RD ST	Gates	70	58			2,100	Paved	45	0.0344	121,800

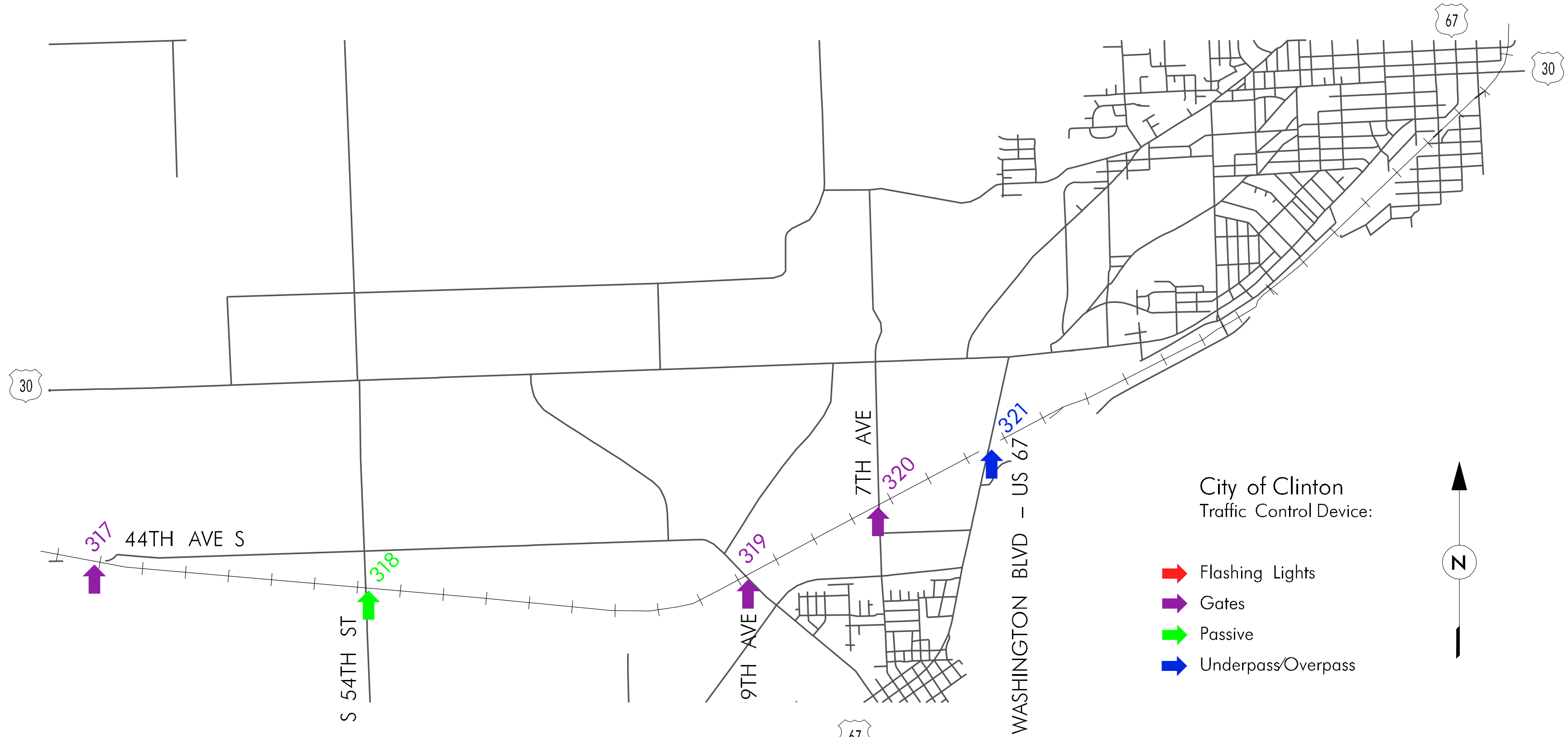
De Witt Urban Area Map



De Witt Urban Area Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001		AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
						Colli-sions	Collision Deaths					
306	916822U	LAKE ST*	Passive		0			1,140	Paved	35	0.0000	0
307	190389S	9TH AVE	Gates	70	58			434	Paved	25	0.0243	25,172
308	190388K	6TH AVE	Gates	70	58	1		6,700	Paved	35	0.0432	388,600
309	190387D	3RD AVE E	Gates	70	58			380	Paved	25	0.0236	22,040

*Data is incomplete.

Clinton Urban Area Map



Clinton Urban Area Rail-Highway Crossings													
Rail Data								Road Data			Calculated Fields	
ID Number	FRA Number	Street/Road-Highway	Traffic Control Device	Speed	Number of Trains	1996-2001		AADT	Surface Type	Posted Speed Limit	Predicted Accidents	Exposure
						Colli-sions	Collision Deaths					
317	190376R	44TH AVE S	Gates	70	58			260	Paved	45	0.0216	30,160
318	190374C	S 54TH ST	Passive	60	58			140	Gravel	45	0.0328	8,120
319	190371G	9TH AVE	Gates	70	58			1,110	Paved	25	0.0302	64,380
320	190370A	7TH AVE	Gates	70	58			1,870	Paved	35	0.0336	108,460
321	190369F	WASHINGTON BLVD-US 67	Underpass	0	0			11,400	Paved	45	0.0000	0

Appendix B – Possible Funding Sources

Possible Funding Sources

Below are some possible existing funding sources for grade separations, but a specific project application would require further investigation to determine project eligibility within program guidelines. Some of these sources are included in this listing, but have not traditionally been used to fund project needs.

Federal

National Highway System (NHS)

Program provides funding for improvements to rural and urban roads that are part of the NHS, including designated connections to major intermodal terminals.

Surface Transportation Program (STP)

Ten percent of these funds must be set aside for safety construction activities that include rail-highway crossings and hazard elimination projects. STP funds are also available for state and local crossing improvements.

Federal-Aid Rail/Highway Crossing Safety Fund

Funds are used for safety improvements at rail-highway crossings. Factors considered are improvement costs, highway and train traffic, and accidents.

Transportation and Community and System Preservation Pilot Program (TCSP)

Discretionary funds are awarded to implement corridor preservation strategies based upon an annual competitive application process.

Special Legislative Funding

Under TEA-21, 16 high-priority projects received special earmarked funding; two of these are grade separations. Special funding requests under the annual appropriations bill can be rail-highway projects.

Railroad Rehabilitation and Improvement Financing (RRIF)

Program provides direct loans and loan guarantees for railroad capital improvements from the U.S. Treasury. A credit risk premium is required prior to funding approval.

Transportation Infrastructure Finance and Innovation Act (TIFIA)

Provides federal assistance in the form of credit to help fund major transportation investments of critical national importance. Project must cost at least $100 million to quality for assistance.

High-Speed Rail Grade Crossing Improvement Program

Program provides financial assistance to states to fund crossing improvements in designated high-speed corridors. Currently, Iowa has no designated corridors.

State

Traffic Safety Improvement Program

Program funding comes from one-half of one percent of Iowa’s Road Use Tax Fund and is used for traffic safety improvements or studies on public roads.

Urban-State Traffic Engineering Program (U-STEP)

Funds share the construction cost of traffic engineering improvements at one or more intersections or other traffic bottlenecks.

Iowa's Clean Air Attainment Program (ICAAP)

The federal Congestion Mitigation and Air Quality (CMAQ) program provides funds to maintain Iowa's clean air condition through eligible congestion and air quality improvement project activities.

Revitalize Iowa's Sound Economy (RISE) Program

Funds promote economic development through construction or improvement of roads and streets and must assist new industry or expand existing industry.

Rail Economic Development (RED) Program

Rail funds promote economic development.

Rail Revolving Loan Fund

Fund provides loans for railroad-related projects including main lines, branchlines, switching yards, sidings, rail connections, intermodal yards, highway grade separations and other rail-related improvements.

City and/or County

General Obligation (GO) Bonds

Bonds can be issued to assist in funding various infrastructure needs.

Local Option Sales Tax

This mechanism funds a variety of specific community needs.

Property Taxes

Funds can be used for various infrastructure needs.

Other Funding Sources

Railroads

Railroads spend over $50 million a year nationally for crossing improvements. These are about equally divided between warning devices, surfaces and grade separations.

Private Companies

Private companies can make project investments.

Other States

Nebraska Train-Mile Tax

Nebraska levies an excise tax on rail carriers carrying freight that operate in the State. The tax was enacted in 1979 and two years later it was amended to a train-mile basis rather than a ton-mile basis. The current tax rate of $0.075 per train-mile was set in 1984 and is based on a train traveling one mile irrespective of the number of cars in the train. Revenue from the tax is deposited in the Grade Crossing Protection Fund. Funds can be used to construct and maintain grade separations.